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Research Problem Review 75-3

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LEVEL II

# A COST ASSESSMENT OF ARMY TRAINING ALTERNATIVES

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Army Project Number

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Individual Performance  
Evaluation

Research Problem Review 75-3

(6) A COST ASSESSMENT OF ARMY  
TRAINING ALTERNATIVES

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## FOREWORD

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A primary mission of the Individual Training and Performance Evaluation Technical Area of the Army Research Institute for the Behavioral and Social Sciences (ARI) is to support the Army's Enlisted Personnel Management System (EPMS) by developing and providing suitable performance-oriented training and testing for individuals. Under EPMS, training of individuals beyond initial entry-level courses is given increased emphasis; an important component of individual training is that provided at the unit or company level. The Army has developed a system of self-paced audiovisual lessons--the Training Extension Course (TEC)--designed to upgrade individual skills and to help commanders conduct this individual proficiency training. The TEC program is now being implemented throughout the Active Army, Reserve Components, and senior ROTC units.

This Research Problem Review is part of a series of reports on TEC; it compares the estimated cost data of TEC training with conventional Army classroom instruction. A forthcoming ARI report evaluates the comparative effectiveness of the two systems, thus providing a cost-effectiveness view.

ARI research in this area, conducted under Army Project 2Q763731A733, FY 75 Work Program, is responsive to special requirements from the Army Training and Doctrine Command (TRADOC) and the Army Combat Arms Training Board (CATB). The research is conducted as an in-house effort augmented by contracts with organizations selected for their capabilities in training research. The present study was conducted jointly by Dr. James A. Caviness of ARI at the U.S. Army Infantry Human Resources Unit at Fort Benning and by personnel from Research for Better Schools, Inc., Philadelphia, with major support from CATB personnel at Fort Benning, particularly CPT William Neal.



J. E. UHLANER,  
Technical Director

## A COST ASSESSMENT OF ARMY TRAINING ALTERNATIVES

### BRIEF

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#### Requirement:

*LD The Army requires*

To provide comparative cost data on the Training Extension Course (TEC) for individualized instruction and on equivalent conventional Army group instruction, as part of a cost-effectiveness study of TEC.

#### Procedure:

Costs were estimated from available data and tabulated for the development and operational use of typical TEC lessons and for conventional group instruction. A comparison module (arbitrarily defined as 100 lessons a year to each E3 and E4 in a standard infantry battalion) enabled comparison of operational costs in the two systems. Costs of activities common to both were not considered.

#### Findings:

For TEC, development cost was estimated to average \$15,920 per lesson. Operational cost was estimated to average \$38,279 per battalion (533 men). The conventional system has no development costs; operational costs equivalent to 100 TEC lessons were estimated at \$47,437 per battalion, chiefly in the instructors' time. Under a projected expanded utilization to 1,064 battalions per year, TEC annual costs (including lesson development and revision) would total \$42,100,000 against projected conventional annual costs of \$50,473,000. Based on an estimated 5-year lesson life, development costs under expanded utilization are estimated at about \$600 per battalion for 200 lessons, with an additional estimated annual cost for revisions of \$690 (1975 dollars) per battalion.

#### Utilization of Findings:

*Study findings indicate that*

Use of TEC individualized instruction with either cassette tape or audiovisual aids is projected to be less costly in comparison to conventional instruction as volume of use increases.

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## A. COST ASSESSMENT OF ARMY TRAINING ALTERNATIVES

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## A COST ASSESSMENT OF ARMY TRAINING ALTERNATIVES

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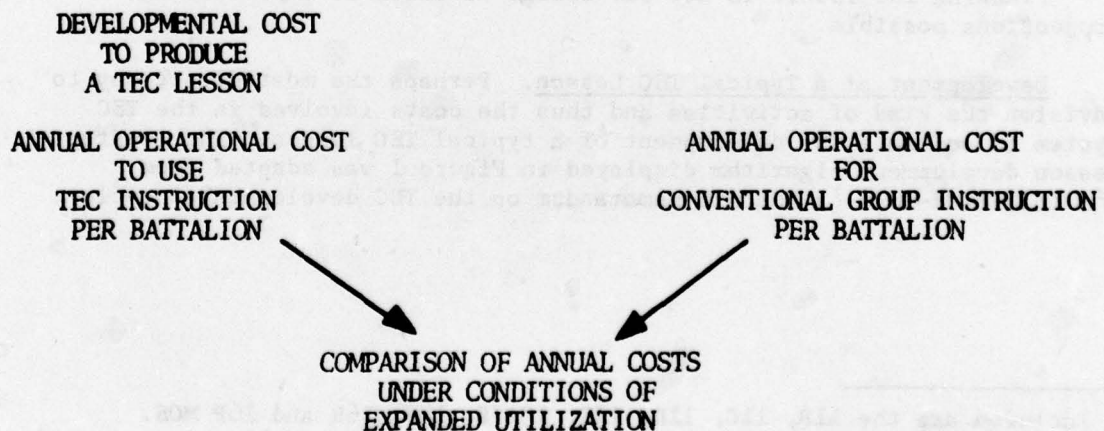
This report provides cost information to be used with effectiveness information to provide cost-effectiveness assessments of two instructional (training) approaches--Training Extension Course (TEC) and conventional Army group instruction.

This report (1) describes and estimates the cost factors related to both development and operational use of the two instructional alternatives, (2) compares the cost estimates, and (3) projects those cost estimates in the context of expanded utilization. Costs of activities common to both approaches have not been considered.

A basis of comparison (referred to as the comparison module) was applied to both training approaches and used to compare the costs of both. The comparison module is defined as the cost to provide 100 lessons per year to each of the 533 E3 and E4 personnel in a typical infantry battalion. Although it is not likely that a battalion currently trains as many as 533 men by means of TEC, the comparison module made it possible to apply the same criteria to both TEC and conventional group instruction.

When the analysis was extended from a single battalion focus to a multiple battalion or expanded utilization focus, the comparison module was projected to include 1064 battalions.

The basic cost analysis approach used in this report is presented below.



This report is based on available data. (See Appendix A for original cost matrix.) When available data were insufficient for confident estimates, the data are reported, but limitations are stressed. Studies now being conducted by the Army Research Institute (ARI) and the U. S. Army Combat Arms Training Board (USACATB) should enable the Army to improve some of the estimates provided in this report.

## TEC INSTRUCTION

In this section, the developmental costs and operational training costs for TEC instruction are considered. TEC is designed to enable the individual soldier to pace himself through an audiovisual training experience. Discussions of each cost category together with summaries of developmental and operational use costs are provided.

### DEVELOPMENT OF TEC LESSONS

TEC II, III and IV. TEC II refers to the system developed for eight of the combat arms MOS within the four combat arms schools (CAS).<sup>1</sup> TEC II basically includes instructional content covering shooting, moving, and communicating for those eight MOS.

TEC III includes instructions for personnel filling five critical duty positions--unit clerk, PLL clerk, TAMMS clerk, Generator Operator, and Radio-Teletypewriter Operator.

According to information provided by USACATB, TEC II is scheduled to develop 517 lessons in FY 74, 114 lessons in FY 75, and 76 lessons in FY 76. TEC III is scheduled to develop 115 lessons in FY 75.

Planning for TEC IV is not far enough advanced to make detailed projections possible.

Development of a Typical TEC Lesson. Perhaps the most direct way to envision the kind of activities and thus the costs involved in the TEC system is to trace the development of a typical TEC lesson. The 26-step lesson development algorithm displayed in Figure 1 was adapted from N61 1339-74-R-0036 (a USACATB memorandum on the TEC developmental cycle).

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<sup>1</sup> Included are the 11B, 11C, 11D, 11E, 13A/B, 13E, 16R and 16P MOS. The CAS are the Infantry School at Fort Benning, the Armor School at Fort Knox, the Field Artillery School at Fort Sill, and the Air Defense School at Fort Bliss.



Currently, TEC lessons are being developed by staff from the Infantry School, the Armor School, the Field Artillery School, and the Air Defense School in concert with staff from USACATB. Once a lesson topic has been specified, a task analyst works with a subject matter specialist to assure that the lesson plans are consistent with current Army doctrine. The overall lesson developer, known as the Project Officer, guides the lesson through development; he provides government-furnished materials to the outside contractor, makes sure that the necessary reviews are completed, and charts the progress of the lesson as it progresses through the developmental process.

Among the four combat arms schools, the developmental process for a TEC lesson varies. Generally, this process includes the following developmental steps or activities:

#### Job Analysis

1. Selection of Duty Position
2. Job ID
3. Preparation of Task Statements
4. Preparation of Task Inventory (lists)
5. Selection of Tasks for Training Development
6. Job Task Data Cards
7. Selection of Common Tasks
8. Field Validation
9. Reviews

#### Curriculum Design

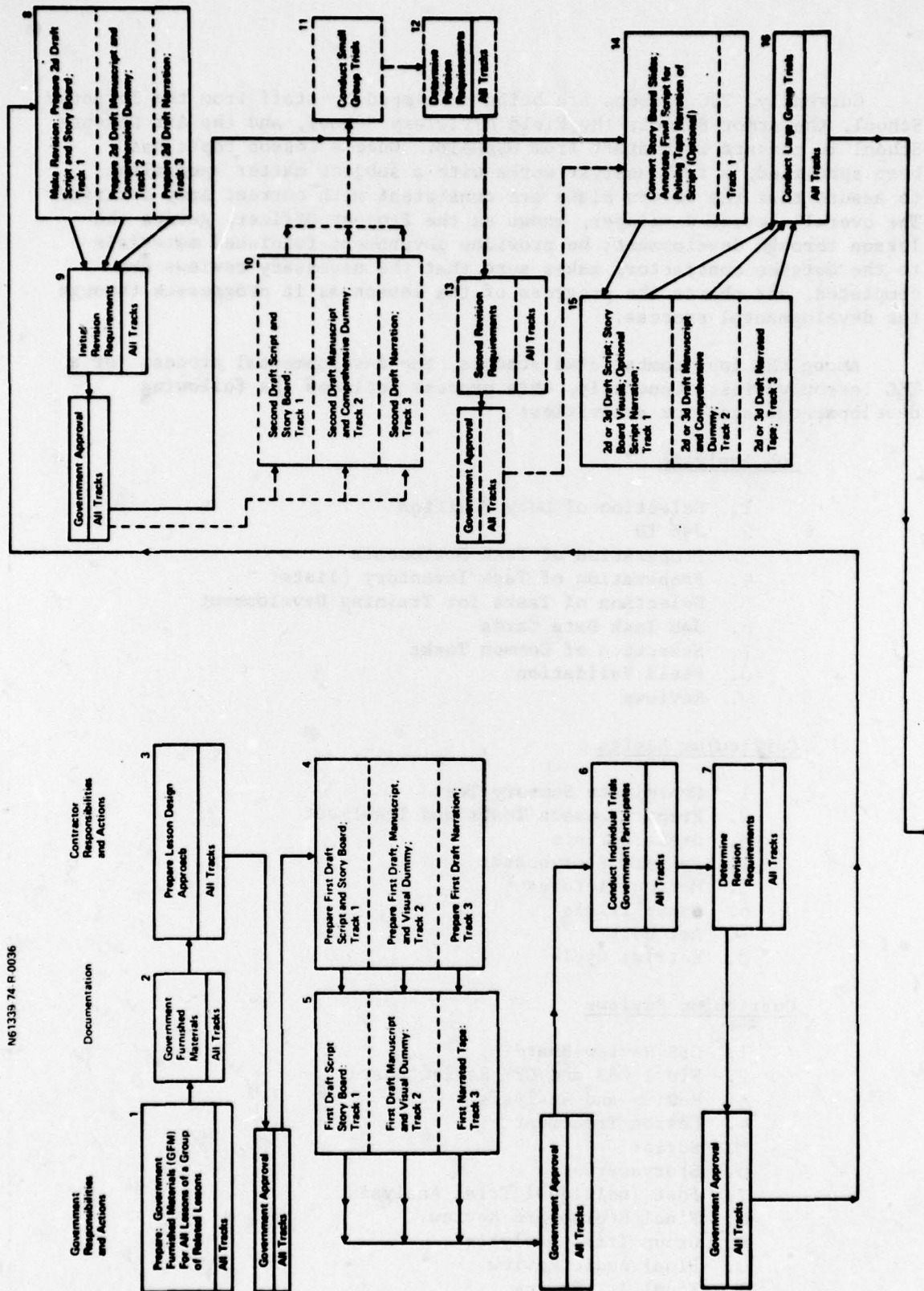
1. Coordinate Summary Test
2. Prepare Lesson Tests and Treatment
3. Draft Scripts
4. Prepare Storyboards
5. Motion Pictures
6. Group Trials
7. Art Work
8. Retrial Cycle

#### Curriculum Reviews

1. CSS Review Board
2. Final CSS and GFM Review Board
3. Review and Analysis
4. Lesson Treatment
5. Script
6. Storyboard
7. Post Individual Trial Analysis
8. Final Storyboard Review
9. Group Trial Analysis
10. Final Audio Review
11. Final Art Review
12. Answer Print Review and Approval  
(35mm and Super 8mm)

Track 1 - Audiovisual  
Track 2 - Printed  
Track 3 - Audio Only

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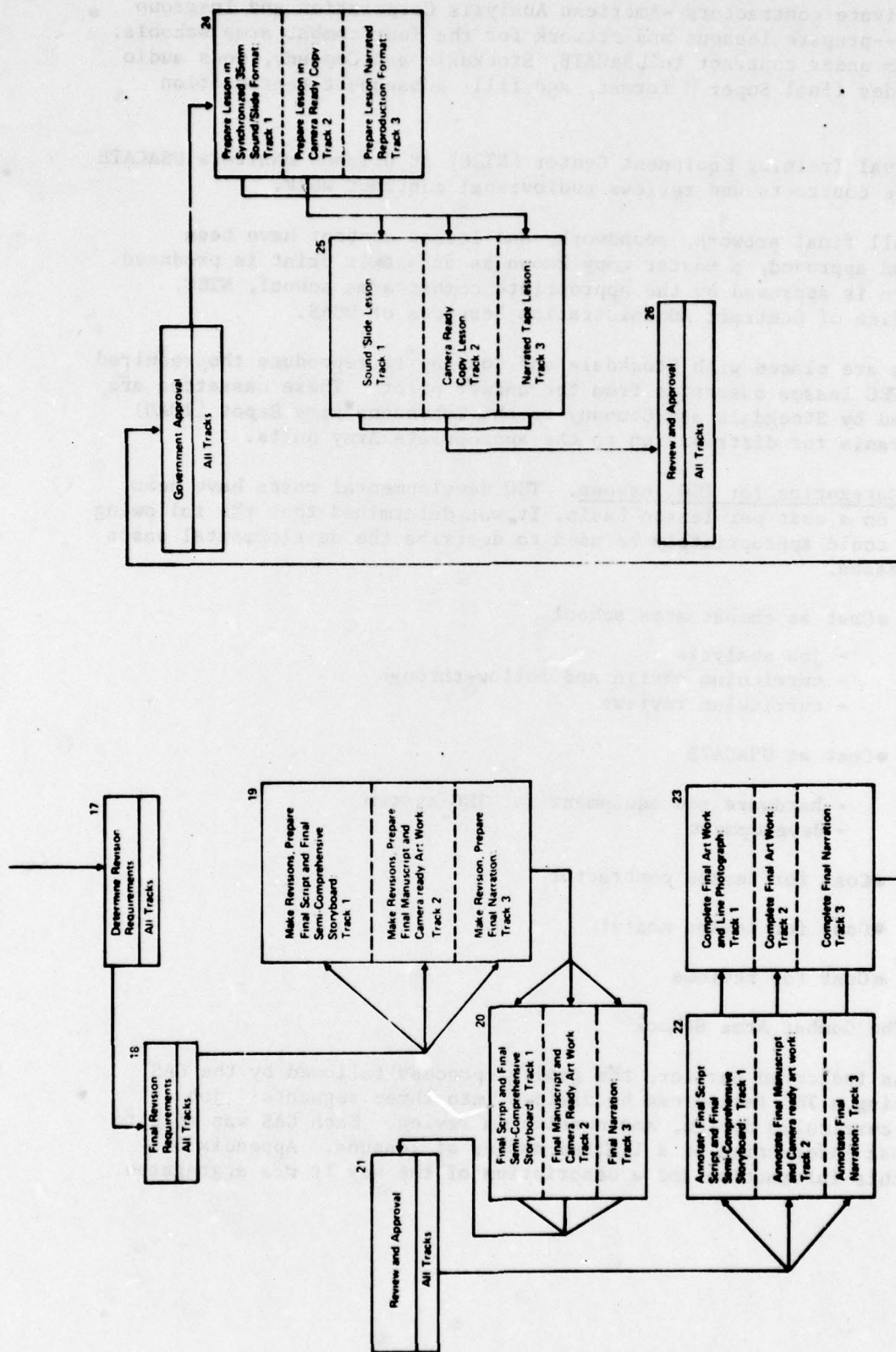


Figure 1. TEC lesson development flow diagram



Two private contractors--American Analysis Corporation and Insgroup Corporation--prepare lessons and artwork for the four combat arms schools. Another firm under contract to USACATB, Stockdale and Company, does audio work, provides final Super 8 format, and fills subsequent reproduction orders.

The Naval Training Equipment Center (NTEC) at Orlando monitors USACATB TEC hardware contracts and reviews audiovisual contract work.

When all final artwork, soundwork, and lesson content have been reviewed and approved, a master copy known as an answer print is produced. This in turn is approved by the appropriate combat arms school, NTEC, and the Office of Contract Administration Services of DCAS.

Orders are placed with Stockdale and Company to reproduce the required number of TEC lesson cassettes from the answer print. These cassettes are then shipped by Stockdale and Company to the Tobyhanna Army Depot (TOAD) in Pennsylvania for distribution to the appropriate Army units.

Cost Categories for TEC lessons. TEC developmental costs have been calculated on a cost per lesson basis. It was determined that the following categories could appropriately be used to describe the developmental costs of a TEC lesson.

- Cost at combat arms school
  - job analysis
  - curriculum design and follow-through
  - curriculum reviews
- Cost at USACATB
  - hardware and equipment for TEC system
  - development
- Cost for lesson contractor
- Cost for lesson master
- Cost for reviews

#### 1. The Combat Arms School

As indicated earlier, the general process followed by the CAS in developing a TEC lesson can be divided into three segments: job analysis, curriculum design, and curriculum review. Each CAS was able to provide cost information on a limited number of lessons. Appendix B presents this information and a description of the way it was aggregated.

The average combat arms school cost per lesson, in 1975 dollars, was \$3,957.33. Average per lesson costs for the three segments of the developmental process were:

job analysis	\$ 409.20
curriculum design and follow-through	2,389.50
curriculum review <sup>2</sup>	1,158.63
	<hr/>
average estimated cost per lesson	\$3,957.33

Several observations should be noted in connection with this average. Some of the cost items vary considerably from school to school. For instance, although one CAS reported \$32,500 in equipment costs, another did not report any costs for equipment. More elaborate developmental procedures are followed in some CAS than in others. One CAS experienced a number of doctrinal changes during the lesson development process as well as considerable difficulty in photographing tanks. Another CAS developed an integrated joint review procedure in cooperation with Army Wide Training Support (AWTS).

## 2. USACATB

Support costs for the TEC system are perhaps best viewed in terms of the way USACATB is organized to deliver that support. USACATB has formed three teams for the TEC system: hardware, development, and implementation.<sup>3</sup>

Costs at USACATB are reported on a per lesson basis in 1975 dollars. Appendix C contains the procedures and information used to calculate the USACATB developmental costs per lesson. The overall figure, \$493.31 per lesson, includes \$128.66 for the hardware team and \$364.65 for the development team.

### • TEC hardware team

The TEC hardware team selected and tested the Beseler CUE/SEE and other equipment used to deliver TEC instruction. (The Beseler is projected for instructional delivery use for TEC III and TEC IV as well as for TEC II.)

The team contracted with the Beseler Corporation for the development of a maintenance manual to be used by Training Aids

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<sup>2</sup> Since review has been considered a separate function, the \$1,158.63 reported here is cited again later under "Cost for reviews." In that section, it is noted that the cost per lesson for CAS review was included here.

<sup>3</sup> The TEC implementation team's costs are not included here. These costs appear in a later section of this report.

Service Office (TASO) units and funded tests on the Beseler CUE/SEE which were conducted by NTEC. Additionally, the hardware team worked with TASO units and operational personnel to facilitate the use and maintenance of all TEC equipment.

The costs for these activities were prorated on the basis projected by USACATB of 3,6000 lessons. The hardware team cost per lesson, in 1975 dollars, is \$128.66.

● TEC development team

The TEC development team created, in joint activity with the combat arms schools, the developmental process for TEC lessons. It also provided liaison between the private lesson contractors and the combat arms schools. Finally, it does some of the actual development work.

Some of the costs reported by this team were directly attributable to TEC II, TEC III, or TEC IV and thus were prorated on the basis of the projected number of lessons for the appropriate lesson group. Other costs were related to setting up and maintaining the entire developmental system. These costs were prorated on the basis of the total number of lessons projected.

The development team cost per lesson, in 1975 dollars, is \$354.65.

3. The lesson contractor

The contract work on both lesson materials and artwork is being performed by American Analysis Corporation and Insgroup Corporation. Work required for audio and final Super 8 format is being performed by Stockdale and Company, who also prepares the answer print or final master lesson from which subsequent copies are made. All developmental contractor costs except the cost of the answer print are included in this cost category. Lesson reproduction is included in the start-up costs for operational training.

Contractor costs per lesson are provided in 1975 dollars. Appendix D presents the contractor costs (excluding the answer prints) for 34 completed TEC II lessons. The contractor cost per lesson is \$10,581.66.

4. The lesson master (answer print)

Appendix E describes the procedure used to separate answer print costs from reproduction costs for lesson cassettes (billing records combined answer print costs with cassette reproduction costs for the lessons). The average answer print cost based on 21 lessons, in 1975 dollars, is \$814.91.



## 5. Reviews

After the answer print has been prepared it is reviewed by the appropriate CAS, NTEC, and the Office of Contract Administration Services of DCAS.

USACATB provided review information, based on telephone conversations with personnel at NTEC and DCAS, which is presented in Appendix F. The review cost per lesson, in 1975 dollars, is \$72.89. As noted earlier, the combat arms schools reported a review cost per lesson of \$1,158.63 which was included in the CAS cost category.

Summary of Estimated TEC Developmental Costs Per Lesson. Overall, the developmental cost per lesson, in 1975 dollars, is \$15,920.10. The estimated costs by category are:

at combat arms school	\$ 3,957.33
at USACATB	493.31
for lesson contractor	10,581.66
for lesson master	814.91
for review	72.89
<hr/>	
average estimated cost per lesson	\$15,920.10

The combat arms school figure is a composite of estimates provided by the schools themselves. As the schools acquire more experience with lesson development and establish better cost tracking procedures, the cost variability from school to school should decrease.

The largest single developmental cost is for the work of the lesson contractor. Figure 2 shows the distribution of the development dollar, by cost category, in percentages.

### OPERATIONAL USE OF TEC LESSONS

TEC is an instructional system which can be used in Army units in a variety of ways, in conjunction with the Beseler CUE/SEE or with a portable cassette tape player for audio-only lessons (cassettes). TEC instruction, though primarily developed for the individual soldier to pace himself through his own instruction, can also be used for group instruction.

This cost analysis is limited to use of the TEC system in an individual mode with audiovisual lessons presented by means of the Beseler CUE/SEE. This is the primary delivery system currently envisioned for the TEC system. The use of a different delivery system would obviously affect operational costs. For example, just as the use of audio-only lessons would reduce developmental costs, TEC group instruction might reduce operational costs.

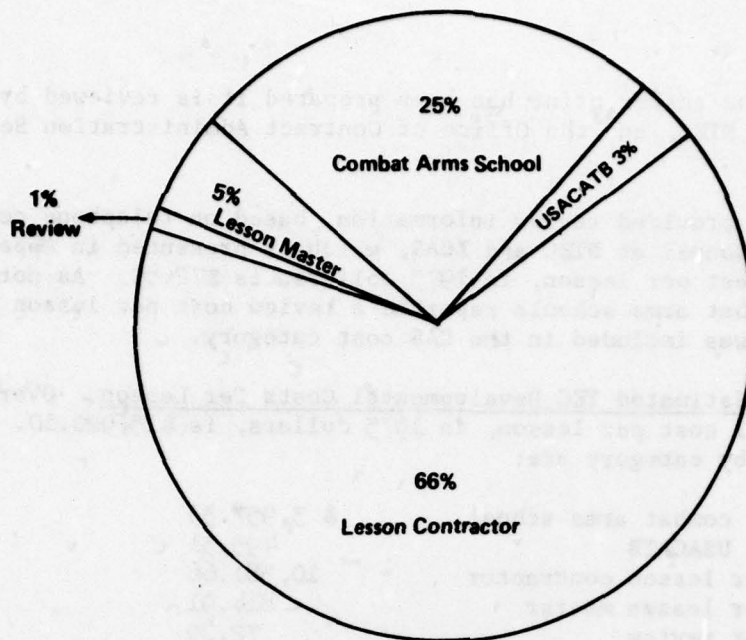


Figure 2. The TEC lesson development dollar, by cost category: In percentages

In this section, operational cost factors are discussed that bear on TEC utilization from the point of distribution at the Tobyhanna Army Depot, through the logistical support provided by TASO, and into the various levels of administrative support required. Start-up costs at the Army unit level are considered together with the costs of providing instruction.

Operational costs are calculated for providing 100 lessons per year to each of the 533 E3 and E4 personnel in a typical infantry battalion (a comparison module).

Certain factors strongly affected many of the cost estimates presented in this section. Data collected by ARI field staff were based on current operating levels for TEC rather than on projected operating levels for broad implementation at the battalion level. This point can be illustrated by comparing the current Basis of Issuance (BOI) of eight Beseler CUE/SEE machines per battalion with the number of machines which would be required if the following assumptions are made:

1. A battalion learning center is open for 250 work days each year.
2. There are eight hours in each work day.

3. Each lesson involves an average of 50 minutes<sup>4</sup> of instructional time.

4. 533 men are provided with 100 lessons each year.<sup>5</sup>

These assumptions were used to estimate the number of Beseler CUE/SEE machines required to provide 100 lessons per year to the 533 E3 and E4 personnel in a typical infantry battalion.

$$\frac{\text{men X lessons X instructional hours per lesson}}{\text{work days per year X work hours per day}} = \text{number of men receiving instruction at any given time}$$

$$\frac{533 \times 100 \times 5/6}{250 \times 8} = 22 \text{ men; thus, 22 machines would be needed.}$$

Present BOI guidelines are assumed to be reasonably close to current utilization levels for TEC. This means that all data reported must be carefully considered as each cost factor is analyzed and estimated. The appendices that support the estimates provided in this section present each cost factor in terms of both the current level of costs reported and the level of costs required to provide 100 lessons per year to 533 men.

Cost Categories for TEC Operational Use. The following categories can appropriately describe the operational costs of the TEC system.

- Cost of lesson distribution
- Cost of logistical support
- Cost of administrative support
- Cost of start-up
- Cost of instructional support

#### 1. Distribution

Distribution of all TEC lesson materials is handled by the Tobyhanna Army Depot. Information on the costs of storage, handling service, and shipping were obtained from USACATB and Tobyhanna.

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<sup>4</sup> This time estimate is discussed in detail in the section on trainee time requirement comparisons.

<sup>5</sup> When the number of soldiers using TEC on an individual basis reaches a certain point, it is likely that a unit would begin to use TEC for groups as well as for individuals.



Distribution costs on a per lesson cassette basis, in 1975 terms, are:

storage	\$ 0.003
handling	1.13
shipping	<u>0.36</u>
average estimated cost per lesson	\$ 1.493 <sup>6</sup>

Storage space for TEC lesson cassettes is currently available at Tobyhanna at no cost. However, it seems advisable to include the storage cost per lesson cassette in projections for the future. The estimated storage cost per lesson, in 1975 dollars, is \$0.003.

TOAD experience in handling 2,957 boxes (which contained the 11,266 TEC lesson cassettes distributed in 1974) shows a handling cost per lesson, in 1975 dollars, of \$1.13.

Shipping these boxes to a number of Army posts resulted in a cost per lesson, in 1975 dollars, of \$0.36.

Appendix G shows how these figures were calculated. Since the instruction provided to each battalion involves an estimated 866 lesson cassettes (see Appendix H) and the average per cassette cost for storage, handling, and shipping is \$1.493, the annual cost per battalion, in 1975 dollars, is \$1,292.94.

## 2. Logistical Support

In this cost category, both lesson and equipment float factors are considered. TOAD provides some TEC lesson float and the Training Aids Service Office (TASO) provides float for both lesson cassettes and equipment.

The term "float" refers to items kept in reserve so that normal functioning items can be exchanged for any that malfunction. The actual float requirements for TEC lessons and equipment are currently under study.

In order to estimate float requirements, the number of lesson cassettes and support equipment pieces must be known. As indicated previously, present BOI guidelines cannot support 100 lessons per year for 533 men. Appendix H gives estimates for float requirements for equipment and lessons. The annual estimated equipment float cost per battalion is \$232.93 and the annual estimated lesson cassette float cost per battalion is \$216.50. Total estimated logistical support, in 1975 dollars, is \$449.43.

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<sup>6</sup> The \$0.003 represents an inconsistency in the reporting of costs since all other costs per lesson were rounded to the nearest \$0.01. It is reported this way rather than on a per box basis (\$0.01 per box) in order to maintain the cost per lesson focus that has been established.

### 3. Administrative Start-up Support

Brigade level and battalion level S-3 personnel are assigned functions designed to ensure the combat effectiveness of the troops under their command. They establish training priorities and schedules, schedule exercises, prepare scenarios for those exercises, and inspect training sites to determine how training is being conducted. These functions are, of course, necessary for both TEC and conventional group instructional approaches.

ARI staff conducted interviews with TEC support personnel at Fort Carson, Fort Lewis, and four 38th National Guard sites. TEC managers (usually at brigade or battalion level) and TEC supervisors (usually supervisory learning center personnel at the battalion or company level) provided information on the percentage of their time spent in TEC support activities.

Because TEC is a new instructional approach and because it is being used to expand the learning center model,<sup>7</sup> unique S-3 support costs are being experienced. These costs are related to learning about the TEC system and becoming familiar with its equipment and the various ways it can be implemented. Many of these activities and, therefore, the costs involved are probably transitional. Until more information is available on the actual implementation of TEC under operational conditions, it is prudent to attribute these costs to TEC (as extra costs related to its introduction). These costs may have been overestimated since they appear to be transitional only.

Comparable data were available for seven active Army battalions. The basis of calculation is described in Appendix I. The annual estimated cost per battalion for administrative support, in 1975 dollars, is \$22,219.48.

### 4. Start-up

Each battalion has certain expenses which are defined as start-up costs because they are incurred when the decision is made to use TEC for operational training purposes. Included are costs for procuring Beseler CUE/SEE equipment, tape cassette players, and TEC lesson cassettes as well as any costs involved in adapting learning center facilities.

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<sup>7</sup> Each learning center model is to include TEC equipment and lesson cassettes, an MOS library, and career counseling personnel.

Appendix H presents the following cost estimates:

procurement of Beseler CUE/SEE and cassette tape player equipment	\$1,922.34
procurement of lesson cassettes	1,966.39

Appendix I presents a cost estimate for the adaptation of existing facilities	<u>365.31</u>
average start-up cost estimate	\$4,254.04

#### 5. Instructional Support

This category covers only the cost of providing instructional support for trainees. Training time per trainee is included elsewhere.

Appendix J provides information on how these estimates were calculated. The annual estimated cost for instructional support per battalion, in 1975 dollars, is \$10,063.46.

Summary of Estimated TEC Operational Use Costs. The cost factors related to operational training have been adjusted to an annual estimated cost per infantry battalion, in 1975 dollars. These estimated costs by category are:

lesson distribution	\$ 1,292.94
logistical support	449.43
administrative support	22,219.48
start-up	4,254.04
instructional support	<u>10,063.46</u>

estimated annual cost per battalion	\$38,279.35
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Personnel support for TEC, both administrative and instructional, can be pooled (\$32,282.94). Administrative costs at both the brigade and battalion level are assumed to be common to both instructional approaches and thus were not included. The TEC administrative costs estimated above are included to cover the extra amount of time that supervisory personnel perceive as needed for TEC support activities.

Figure 3 shows the distribution of the TEC operational use dollar, by cost category, in percentages.



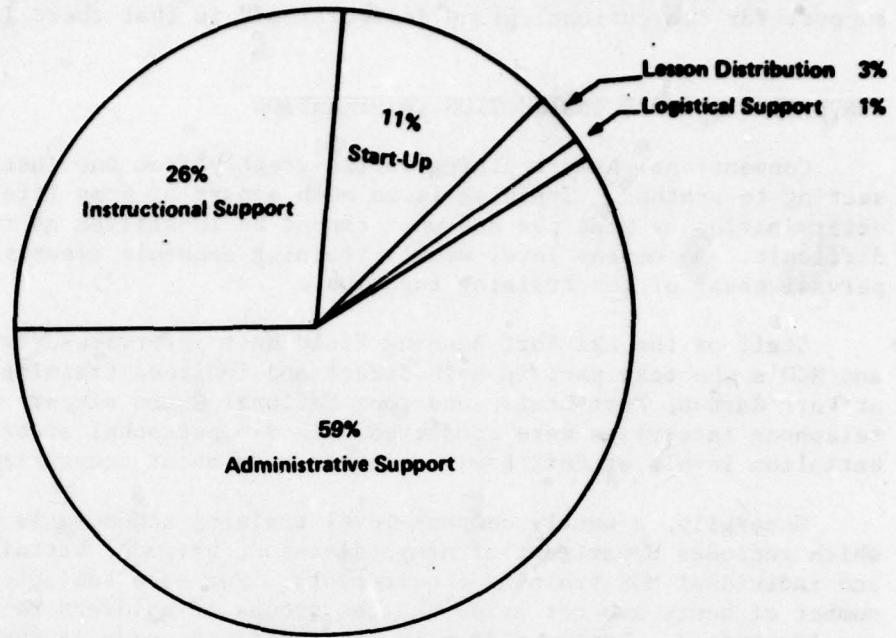


Figure 3. The TEC operational use dollar, by cost category:  
In percentages.

#### CONVENTIONAL GROUP INSTRUCTION

##### DEVELOPMENTAL SUPPORT FOR CONVENTIONAL INSTRUCTION

The Army has developed field manuals (FM) and technical manuals (TM) which serve as a repository of doctrine and are periodically revised to include the most current doctrine. Field manuals and technical manuals are used by officers and NCO's for guidance in preparing conventional instruction. They have also been used to prepare the instructional content for TEC lessons. Since the FM/TM system is a common base for both conventional group instruction and TEC, it is not included in this cost analysis.

It could be argued that the time an instructor spends in preparing for a group instruction class should be considered a developmental activity, because it is functionally parallel to the TEC developmental process. This argument has been rejected; the time an instructor spends preparing for a class and in the classroom as well as the time spent by other personnel in support of the instructor and class have been included as operational costs.

Thus, the answer to the question "What is the cost of developmental support for conventional group instruction?" is that there is no cost.

#### CONVENTIONAL GROUP INSTRUCTION IN OPERATION

Conventional Army training varies greatly from one instructional setting to another. Training is so much a part of Army life that determination of what can and what cannot be identified as training is difficult. A company level weekly training schedule clearly shows the pervasiveness of the training function.

Staff of the ARI Fort Benning Field Unit interviewed training officers and NCO's who take part in both direct and indirect training activities at Fort Carson, Fort Lewis, and four National Guard sites. Additional telephone interviews were conducted with S-3 personnel at brigade and battalion levels at Fort Lewis to learn more about conventional training.

Generally, a weekly company-level training schedule is prepared, which includes Department of Army, division, brigade, battalion, company, and individual MOS training requirements. For each subject, a certain number of hours are set aside and the groups of soldiers to be trained are identified. Every soldier in an identified group is supposed to receive the designated instruction.

Actual training is variable from situation to situation. It may vary in terms of (1) the individuals who actually receive the training, (2) the instructional setting, and (3) the instructional objectives established. While every soldier is supposed to receive training at those times specified for him, priorities may conflict with the training schedule; an E1 may have his training postponed due to a conflicting assignment specified on the company duty roster. Each instructor blends his experience, knowledge and instructional skills to create an appropriate setting for each class. For example, some instructors may provide practical field exercises while other instructors in the same subject area do not. The instructor may also provide his own objectives, as for example, one who has been told to prepare a three hour class on "Considerations of Offensive Combat" and has been provided with references for FM 7-11/7-20/23-6. (This example was taken from a weekly training schedule prepared by a combat support company.)

When TEC instruction was analyzed under operational conditions, a comparison module was used, the provision of 100 lessons per year to each of 533 men in a battalion. In this section, these conditions were applied to conventional group instruction so that this instructional approach could be compared to the TEC approach.

Cost Categories for Conventional Group Instruction. The only operational cost category for conventional group instruction includes costs for instructor preparation time, instructor class time, and direct support time at the company level. Brigade and battalion level S-3 support and coordination are necessary for both training approaches.

Training personnel from ten conventional group training sites were observed and interviewed during the effectiveness testing conducted by ARI. ARI staff provided information on the amount of time spent by the instructor in preparing for the class, his instructional time during the class itself, and the support time provided by other personnel.

Appendix K describes the methods used to estimate the annual per battalion cost of providing conventional instruction equivalent to 100 TEC lessons for 533 men. This cost estimate, in 1975 dollars, is \$47,437.

#### COMPARISON OF OPERATIONAL COSTS FOR TEC AND CONVENTIONAL GROUP INSTRUCTION

Use of a comparison module in considering cost estimates based on available and derived Army data has two advantages. First, this approach provides reasonable assurance that the comparison is based upon operational settings. Second, since TEC implementation levels vary widely from battalion to battalion, the use of the comparison module made it possible to adjust these differences to a common level.

Two disadvantages result from using the comparison module. First, because currently available data were adjusted to a comparable operational level, it is likely that these estimates reflect an operational setting that does not now exist in any battalion. Second, a number of assumptions were necessary to express present levels of operational activity in comparable terms. Some of these assumptions, especially the 2.75 factor employed in the section on TEC operational costs, are somewhat arbitrary. As better estimates based on actual operational experience with TEC become available, however, each calculation can easily be revised to reflect this experience.

The operational use costs per battalion per year to provide the equivalent of 100 TEC lessons to 533 men, in 1975 dollars, are

<u>TEC</u>	<u>CONVENTIONAL GROUP</u>
\$38,279	\$47,437

Can these two cost estimates be considered equivalent in all respects? The answer, of course, depends on the extent to which trainee time requirements for a TEC lesson are similar to trainee time requirements for the same instructional content presented by conventional group instruction.

ARI staff observed 15 TEC instructional settings and 10 conventional group settings to provide comparable trainee time data. The mean reported instructional time per TEC lesson was 55 minutes. The mean time required for conventional group instruction was 53 minutes. Appendix L presents the data and a comparison of these data.



During TEC instruction, trainees were not permitted to pre-test out of the lessons--a feature of TEC instruction under actual operational conditions--since they were tested in group settings. Thus, the reported time estimates represent group figures rather than time estimates for individual soldiers.

For conventional group instruction, the sample of 10 classes is somewhat small for the amount of variability observed.

While the two time estimates have been treated as equal, an overall mean of 50 minutes per lesson was used for the TEC time estimates, because it is likely that the TEC trainee time was overestimated.

#### COMPARATIVE ANNUAL COSTS UNDER CONDITIONS OF EXPANDED UTILIZATION

In this section, cost implications of TEC under conditions of future expanded utilization are compared with those of conventional group instruction.

Expanded utilization is defined as the provision of 100 TEC II lessons per year to each of 533 men per battalion for 1064 battalions. Before continuing, it seems reasonable to explain the derivation of the 1064 battalion figure (see Appendix M).

1. Table M<sub>1</sub> shows the 16 combat arms battalions and 3 combat support battalions projected to use TEC II in an infantry division. (A number of separate batteries and companies also use TEC II.)

2. Each soldier uses those TEC lessons that are both common to his branch and unique to his MOS. Different soldiers, then, are projected to use different mixes of TEC II lessons. Since the number of lessons per soldier per year has been fixed at 100 for the purposes of this study, exact lesson titles are not needed here. Two hundred TEC lessons are projected by USACATB for use by each infantry battalion. These lessons provide the pool from which each soldier selects the lessons he needs. Table M<sub>2</sub> shows the projected use of TEC II lessons by each organizational unit within an infantry division.

3. USACATB has projected that TEC II potentially can be used by 308 active Army and 355 reserve combat arms battalions and by 331 active Army and 372 reserve combat support and combat service battalions, as well as by a large number of combat support and combat service companies. National Guard battalions are excluded because information on them was not available in sufficient time to include their projections.

4. When the 4:3 ratio of combat support to combat service battalions (as in the infantry division in Table M<sub>1</sub>) is applied to separate the 703 combat support and combat service battalion figure into

its two components, the result is 401 combat support battalions and 302 combat service battalions.

5. The expanded utilization base for TEC II is assumed to include 663 combat arms battalions and 401 combat support battalions. Combat service battalions in an infantry division will not receive TEC II lessons.

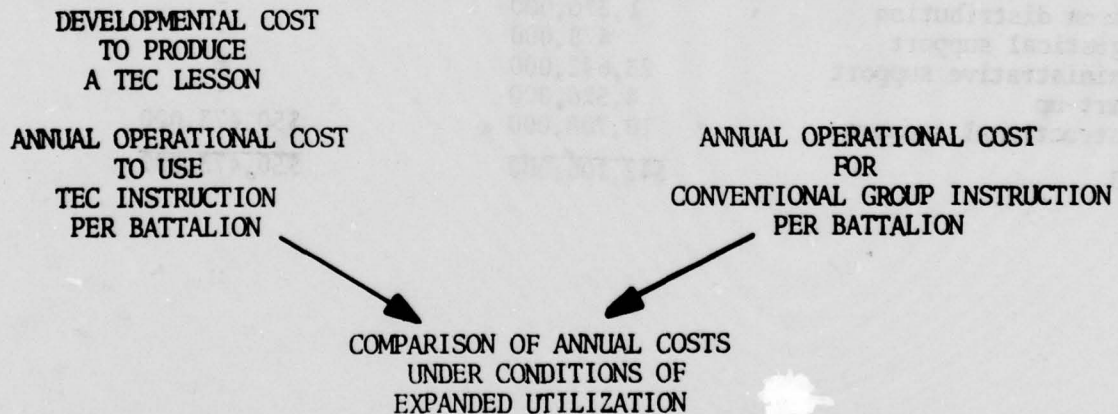
6. Finally, the cost estimates previously calculated for an infantry battalion are applied to each of the 1064 battalions.

Using these assumptions as a base, it is feasible to examine and compare the implications of expanded utilization of TEC II in relation to conventional group instruction.

#### COMPARISON SUMMARY

The basic cost analysis approach began with the calculation of TEC developmental costs per lesson. Then, annual operational costs per battalion were derived for both training approaches. In this section, operational cost information for both approaches is projected to an expanded utilization base. A number of qualifications and data limitation statements are contained in both the following sections and in the appendixes.

#### BASIC COST ANALYSIS APPROACH



NOTE: COSTS FOR ALL ACTIVITIES COMMON TO BOTH APPROACHES HAVE BEEN EXCLUDED.

The Expanded Utilization Comparative Annual Cost Table which follows presents the implementation costs calculated for the comparison module projected to include 1064 battalions. On the TEC side of the ledger, costs are presented for the development of TEC II, doctrinal revision, logistical support, administrative support, start-up, and instructional support. Under conventional group instruction, the only cost is for instruction. Figure 4 provides a graphic comparison of the estimated total costs of the two instructional approaches. In this section, all of these costs are calculated and discussed, and technological obsolescence is also considered.

EXPANDED UTILIZATION COMPARATIVE ANNUAL COST TABLE:  
IN 1975 DOLLARS, ROUNDED TO THE NEAREST \$1,000

<u>COST CATEGORY</u>	<u>TEC</u>	<u>CONVENTIONAL GROUP</u>
Development:		
Lesson Development	637,000	-
Lesson Doctrinal Revision	733,000	-
Operations:		
Lesson distribution	1,376,000	-
Logistical support	478,000	-
Administrative support	23,642,000	-
Start-up	4,526,000	-
Instructional support	10,708,000	\$50,473,000
Total	<u>\$42,100,000</u>	<u>\$50,473,000</u>



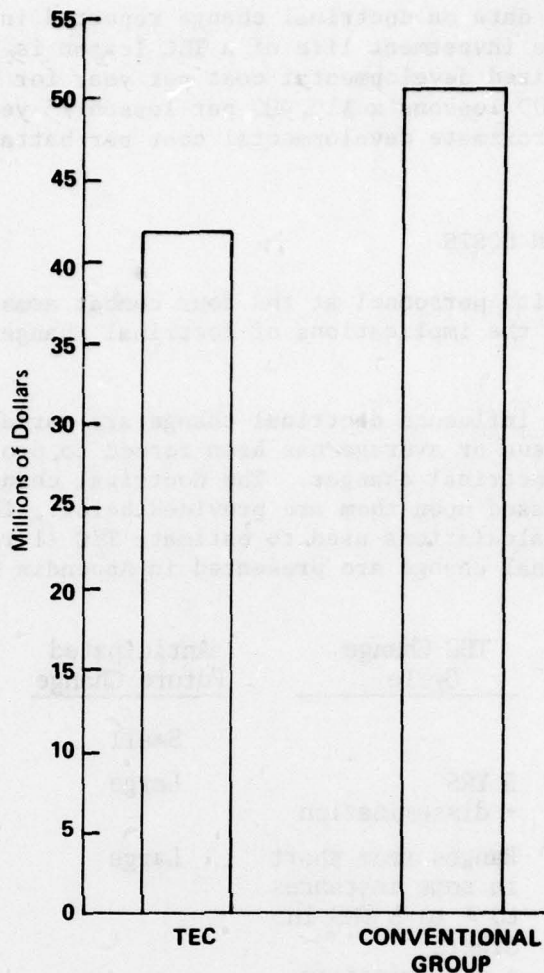


Figure 4. Comparative annual costs for TEC and conventional group instruction under conditions of expanded utilization (Millions of dollars)

#### DEVELOPMENT COSTS

Conventional group instruction is considered to have no development costs, although it could be argued that instructor class preparation is equivalent in function to lesson development (preparation) for TEC. Instructor class preparation time has been included as an operational cost.

TEC developmental costs represent an initial investment rather than an annual operational cost. Thus far, the costs of this initial investment have not been included in any comparisons. Nevertheless, to provide the most comprehensive comparison possible between TEC and conventional group training, TEC developmental costs are included in this discussion of expanded utilization.

Based on the data on doctrinal change reported in Appendix N, it is estimated that the investment life of a TEC lesson is approximately five years. The amortized developmental cost per year for TEC II can be calculated as  $(200 \text{ lessons} \times \$15,920 \text{ per lesson}) / 5 \text{ years} = \$636,800 \text{ per year}$ , with an approximate developmental cost per battalion of \$598 per year.<sup>8</sup>

#### DOCTRINAL REVISION COSTS

Interviews with personnel at the four combat arms schools provided information about the implications of doctrinal change for TEC lessons (Appendix N).

Factors that influence doctrinal change are variable from school to school. A consensus or average has been formed to project the cost implications of doctrinal changes. The doctrinal change judgments and the projections based upon them are provided below. The detailed assumptions and calculations used to estimate TEC II revision costs related to doctrinal change are presented in Appendix N.

<u>School</u>	<u>TEC Change Cycle</u>	<u>Anticipated Future Change</u>	<u>Ease and Quickness of TEC Response<sup>9</sup></u>
Infantry	-	Small	High
Armor	3 YRS + dissemination	Large	High
Artillery	Ranges from short in some instances to 4 to 5 YRS in others + dissemination	Large	High
Air Defense	1-1/2 to 2 YRS + dissemination	-	High

<sup>8</sup> Based on 1064 battalions and the 200 TEC II lessons projected for use by an infantry battalion. Were the number of lessons expanded to include other kinds of Army units or to include the full 3,600 lessons projected, total developmental costs would be estimated at \$57 million. This figure would, of course, be prorated over a large number of battalions and over many years.

<sup>9</sup> In many ways, the question of how quickly TEC lesson revision can be accomplished is a policy variable. The FM/TM system, as the repository for current doctrine, usually responds on a 3 to 4 year cycle. Within limits, the TEC lesson response cycle can be as rapid as desired but, of course, at a cost.

The overall estimated annual cost per battalion of doctrinal revision for TEC II, in 1975 dollars, is \$688.80. The cost categories included in this figure are:

combat arms school redevelopment	\$ 24.80
USACATB redevelopment	12.69
answer print revision	2.55
distribution	136.87
lesson float	95.73
lesson procurement	416.16

annual estimated cost per battalion for doctrinal revisions	\$688.80
--	----------

When the annual estimated per battalion figure is multiplied by 1064, the overall estimate for doctrinal revision of TEC lessons is \$732,883. Conventional group instruction involves no comparable costs.

#### ANNUAL OPERATIONAL COSTS

Expanded utilization costs in five operational use cost categories-- lesson distribution, logistical support, administrative support, start-up, and instructional support--were estimated by multiplying each of the previously derived annual operational costs per battalion by 1064. This was done for both training approaches. The expanded costs are presented in the Expanded Utilization Comparative Annual Cost Table.

#### EFFECTS OF TECHNOLOGICAL OBSOLESCENCE

USACATB projects that the Beseler CUE/SEE and the tape cassette player will be adequate for delivering TEC instruction for "another ten years." Only a progression to other instructional techniques, e.g., interactive branching, would require a different kind of equipment. No comparable considerations are applicable for conventional group instruction.

#### SUMMARY

Cost information from this report is to be used for cost-effectiveness assessments of TEC and conventional group instruction. The major findings are:

- The TEC developmental cost per lesson is \$15,920. The projected 200 TEC II lessons for infantry battalions will cost \$3.2 million to develop. Amortized over a five-year period, the developmental cost per year is \$637,000. When this figure is adjusted to conditions of expanded utilization, the estimate is \$600 for each battalion per year.



- Revision costs for TEC lessons resulting from doctrinal changes are estimated at \$733,000 per year. The annual estimated revision cost is \$700 per battalion.
- The comparison of annual operational costs per battalion for TEC and conventional group instruction, on the basis of the level of implementation assumed in the comparison module, shows conventional group instruction to cost slightly more (\$47,000 compared to \$38,000).
- When cost estimates (including developmental and operational costs) are compared for the expanded utilization of both instructional approaches, conventional group instruction costs slightly more (\$50.5 million compared to \$42.1 million).
- Data on trainee time requirements for the two instructional approaches were inconclusive.

In summary, this component of a larger cost-effectiveness investigation was designed to compare cost estimates for two Army training alternatives. The estimated annual cost for providing the equivalent of 100 TEC lessons per year to 533 soldiers in 1064 battalions is about \$42 million for the TEC approach and about \$50 million for the conventional group approach.

The use of TEC at the level of implementation assumed in this study could represent an annual cost saving for the Army. TEC, reviewed purely from a cost standpoint, represents a strong alternative to conventional Army group instruction for at least a part of the larger Army training program.

SUMMARY OF ESTIMATES

Estimate

TEC Developmental Costs Per Lesson: \$15,920.10

Combat Arms School	3,957.33
USACATB	493.31
Lesson contractor	10,581.66
Lesson master	814.91
Review	72.89

Annual TEC Operational Cost Per Battalion: \$38,279.35

Lesson distribution	1,292.94
Logistical support	449.43
Administrative support	22,219.48
Start-up	4,254.04
Instructional support	10,063.46

Annual Operational Costs for Conventional  
Group Instruction Per Battalion: \$47,437.00

Annual Expanded Utilization Cost for TEC II: \$42,100,000

Lesson development	637,000
Lesson doctrinal revision	733,000
Lesson distribution	1,376,000
Logistical support	478,000
Administrative support	23,642,000
Start-up	4,526,000
Instructional support	10,708,000

Annual Expanded Utilization Cost for  
Conventional Group Instruction: \$50,473,000

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## APPENDIX A

### BACKGROUND INFORMATION

#### The Cost Factor/Resource Category Matrix

The cost factor categories used in this study are:\*

- I. Development
- II. Start-up expenditures
- III. Operations

Figure A<sub>1</sub> shows detailed cost factor categories ranging from front end systems engineering through operations. Figures A<sub>2</sub>\*\* and A<sub>3</sub>\*\* show cost factor categories and resource categories for development and operational training activities respectively. These figures suggest the way in which staff viewed the R&D process and its associated operational training costs at the time the study began. The principal uses of the matrix were:

1. To provide a starting point for staff to use in identifying actual Army expenditures.
2. To provide guidance for the staff gathering the data as well as for those analyzing the data.
3. To provide a single framework for summarizing and aggregating details into a unified picture.

As the study progressed, the formality of the matrix was relaxed (as the practicality of obtaining the various kinds of data became clearer). The matrix was finally abandoned in favor of an information format which was used in preparing the combined ARI/RBS cost-effectiveness report.

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\*RBS' initial approach to examining the costs of the two training approaches was to adapt a framework developed by Gene H. Fisher.

Fisher's structure includes:

- I. Research and Development
- II. Investment
- III. Operating Cost

Fisher's category "Research and Development" was divided into "Front end systems engineering" and "Development" because the initial survey and analysis of the state of individual training in the Army (conducted by the Board of Dynamic Training) as well as much of the early work conducted by the United States Army Combat Arms Training Board (USACATB) actually were research activities whose products are still useful for a wide variety of training purposes for the Army. These early activities are referred to here as front end systems engineering.

Fisher's category "Investment"--in the context of the present study--is more appropriately aligned with the "Start-up expenditures" incurred by an Army unit as it prepares to implement a new training approach.

Fisher's report is Cost Considerations in Systems Analysis. A report prepared for the Office of the Assistant Secretary of Defense (Systems Analysis). Rand Corporation. December 1970, pp. 117-118.

\*\*The symbol T in Figures A<sub>2</sub> and A<sub>3</sub> stands for time. The symbol X indicates that a given cell was designated for data gathering. The letters A, B, ..., refer to the sub-categories listed in Figure A<sub>1</sub>.



**I. FRONT END SYSTEMS ENGINEERING**

- A. Between-MOS Training Needs Analysis and Assessment
- B. Within-MOS Job and Task Analysis
- C. Identification of Critical Skills and Potential Training Methods
- D. Review of Government-Furnished Materials
- E. Analysis of Alternative Administrative Procedures for Training

**II. DEVELOPMENT**

- A. Initial Curriculum Design
- B. Development of Specs for RFP for Software Production
- C. Contractor Selection
- D. Lesson Design
- E. Individual Trials (not included again as part of cost factor III)
- F. Revision and Development
- G. Large Group Trials (not included again as part of cost factor III)
- H. Revision and Development
- I. Approval Processes

**III. START-UP EXPENDITURES**

- A. Procurement of Initial Stock of Training Hardware
- B. Procurement of Initial Stock of TEC Software
- C. Reproduction of Initial Stock of Government-Furnished Materials
- D. Construction and Renovation of Training Facilities

**IV. OPERATIONS**

- A. Deployment of Training Hardware
- B. Distribution of TEC Software
- C. Unit Leadership Training (NCO) in TEC Management
- D. Maintenance and Replacement of Training Hardware
- E. Replacement of Consumable Materials
- F. Replacement of Worn TEC Software
- G. Replacement of Government-Furnished Materials
- H. Central Program Administration (includes evaluation)
- I. Unit Administration and Conduct of Training

**Figure A<sub>1</sub> - DETAILED COST FACTORS**

DETAILED COST FACTORS	(1) FACILITY MAINTENANCE				(2) TRAINING				(3) TRAVEL				(4) TRANSPORTATION MATERIALS				(5) PURCHASING				(6) CONSULTANT SERVICE				(7) CONTRACTOR SERVICE				(8) ORGANIZATIONAL OVERHEAD				(9) OTHER-SPECIFY																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Figure A<sub>2</sub> - The cost factor/resource category matrix (CFM) for development.

Note: T = time.  
 X = cell designated for data gathering.  
 A, B, ..., = categories from Figure A<sub>1</sub>.

DETAILED COST FACTORS	(1) FACILITY MAINTENANCE			(2) TRAINING			(3) TRAVEL			(4) TRANSPORTATION MATERIALS			(5) PURCHASING			(6) CONSULTANT SERVICE			(7) CONTRACTOR SERVICE			(8) ORGANIZATIONAL OVERHEAD			(9) OTHER-SPECIFY		
	OFF NCO EM			OFF NCO TR			OFF NCO EM			OFF NCO EM			OFF NCO			OFF NCO			OFF NCO			OFF NCO EM			OFF NCO EM		
	T	T	S	T	T	T	T	T	S	T	T	T	T	T	S	T	T	S	T	T	S	T	T	S	T	T	S
III. Start-Up																											
A.																											
B.																											
C.																											
D.																											
IV. Operations																											
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E.																											
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H.																											
I.																											

Figure A<sub>3</sub> - The cost factor/resource category matrix (CFM) for operational training costs.

Note: T = time.

X = cell designated for data gathering.

A, B,..., = categories from Figure A<sub>1</sub>.



## APPENDIX B

### DEVELOPMENTAL COST AT THE COMBAT ARMS SCHOOL

The procedures outlined below were applied to CAS developmental costs in order to calculate a cost per lesson. Table B<sub>1</sub> presents the data used to calculate this cost.

1. Information was supplied by the four CAS.
2. The number of lessons each CAS based its costs upon were then identified. In some instances, this number was used directly to obtain the cost per lesson. In other instances, some expenditures (identified using a catalogue of TEC lessons) were considered applicable to a larger number of lessons.
3. The category of expenditure was determined from the information provided, i.e., job analysis (J), development (D), or review (R). In two instances, review costs were not listed as a separate function but were included as an aggregate under the development category. A percentage of review to development costs was calculated from the figures supplied by the CAS which reported review costs separately. This percentage (31.9%) was then used to estimate review costs for the two CAS which reported those costs as an aggregate under the development category so that a reasonable separation could be made.
4. The year of expenditure was noted since that information was needed to determine which inflation factors should be used to convert costs into 1975 dollar terms.
5. In some instances, costs were reported on a two-year basis, e.g., 1973-74. Such costs were prorated over two years, usually with half of the amount in each year.
6. The hourly cost and expenditure items were listed and costed on separate worksheets. The total cost was then posted. Hourly costs were determined on the basis of an eight hour day.
7. Costs were converted into 1975 dollar terms.
8. Costs per lesson, in 1975 dollars, were calculated using the appropriate number of lessons or number of years as a divisor.
9. Costs were totaled by category (J,D,R) for each CAS (see Tables B<sub>2a</sub> and B<sub>2b</sub>).
10. The average costs for each category and each CAS were then averaged and the appropriate overall averages were calculated.
11. The tables that follow show much of the process employed.

TABLE B<sub>1</sub> DEVELOPMENT COSTS AT CAS: IN 1975 DOLLARS

SCHOOL/EX-PENDITURE	NUMBER OF LESSONS CAS ESTIMATES BASED ON	CATEGORY (JOB ANALYSIS DEVELOPMENT REVIEW)	APPLICABILITY	YEAR OF EXPENDITURE	ITEMS	TOTAL COST (\$)	TOTAL COST 1975 (\$)	1975 PER LESSON COST (\$)
Armor	5							
1		J	divide by 5	1973	2 HRS 03; 3 HRS E7; 3 HRS GS12; 1 HR 04; 1 HR E6	71.36	80.09	16.02
2		D	divide by 5	1973	\$20	20.00	22.45	4.49
3		J	divide by 5	1974	6 HRS E7; 4 HRS GS11; 6 HRS 03; 10 HRS E8; 10 HRS E7; 10 HRS E6; 10 HRS E5; 2 HRS GS9; 1 HR GS12	343.80	371.99	74.40
4		J	divide by 5	1974	2 HRS 06; 4 HRS 04; 3 HRS 02; 7 HRS GS12; 2 HRS GS11; 2 HRS GS4; 1 HR 03	187.58	202.96	40.59
5		R	divide by 5	1974	9 HRS 06; 30 HRS GS12; 50 HRS GS11	867.72	938.87	187.77
6		D	applies to lessons produced in FY 74 and FY 75; divide by 146	1973	80 HRS 03	588.80	637.08	4.52
7		D	applies to lessons produced in FY 74 and FY 75; divide by 146	1974	160 HRS 03; per diem: 30 days @ \$25; \$40 taxi; \$112 airfare	2,142.00	2,317.64	15.87

Table B<sub>1</sub> (continued)

SCHOOL/EX-PENDITURE	NUMBER OF LESSONS CAS ESTIMATES BASED ON	CATEGORY (JOB ANALYSIS DEVELOPMENT REVIEW)	APPLICABILITY	YEAR OF EXPENDITURE	ITEMS	TOTAL COST (\$)	TOTAL COST 1975 (\$)	1975 PER LESSON COST (\$)
8		D	divide by 146; 1/2 in 1973 and 1/2 in 1974 for inflation purposes	1973-74	\$51,497.61	51,497.61	56,759.59	388.76
9		D	put 1/2 into development and 1/2 into review and divide by 5	1974	1056 HRS 03	4,092.00	4,427.54	885.51
10		R		1974		4,092.00	4,427.54	885.51
11		D	put 1/2 into development and divide by 5; 1/2 of that in 1973 and 1/2 in 1974 for inflation purposes	1973-74	325 HRS 03; 55 HRS 06; 60 HRS 05; 120 HRS 03; 45 HRS E7; 60 HRS GS14; 60 HRS GS11; 150 HRS GS3	3,474.10	3,829.08	765.82
12		R		1973-74		3,474.10	3,829.08	765.82
13		D	divide by 5; 1/2 in 1973 and 1/2 in 1974 for inflation purposes	1973-74	69 HRS E5; 69 HRS E3; 138 HRS GS11	1,623.57	1,789.45	357.89
14		D	divide by 5	1974	173 HRS E5; 86 HRS E4; 86 HRS E3	1,202.73	1,301.35	260.27
15		D	divide by 5	1974	80 HRS GS12; 80 HRS GS5; 80 HRS GS4; 80 HRS E8; \$200 AMTS support	2,060.80	2,229.78	445.96



Table B<sub>1</sub> (continued)

SCHOOL/EX-PENDITURE	NUMBER OF LES- SONS CAS ESTI- MATES BASED ON	CATEGORY (JOB ANALYSIS DEVELOP- MENT REVIEW)	APPLICABILITY	YEAR OF EX- PENDITURE	ITEMS	TOTAL COST (\$)	TOTAL COST 1975 (\$)	1975 PER LESSON COST (\$)
Infantry	14							
1		D	divide by 14	1973	168 HRS E7; \$1215 travel and per diem	880.32	952.51	68.04
2		D	divide by 14	1974	120 HRS 03; 16 HRS E7; \$1141 travel and per diem	1,018.00	1,101.48	78.68
3		D	divide by 14; 1/2 in de- velopment and 1/2 in job analysis	1972	26 HRS 06; 62 HRS 04; 128 HRS 03; 70 HRS E7; 54 HRS GS3	1,089.47	1,265.57	90.40
4		J		1972		1,089.47	1,265.57	90.40
5		D	divide by 14; 1/2 in de- velopment and 1/2 in job analysis	1973	106 HRS 06; 246 HRS 04; 510 HRS 03; 280 HRS E7; 218 HRS GS3	4,760.41	5,342.88	381.63
6		J		1973		4,760.41	5,342.88	381.63
7		D	divide by 14	1974	53 HRS 06; 123 HRS 04; 255 HRS 03; 140 HRS E7; 109 HRS GS3	5,036.06	5,449.02	389.22
8		D	divide by 14; 1/2 in de- velopment and 1/2 in job analysis	1972	45 HRS 05; 162 HRS 03; 35 HRS E6; 18 HRS GS4	867.30	1,007.49	71.96
9		J		1972		867.30	1,007.49	71.96

Table B<sub>1</sub> (continued)

SCHOOL/EX-PENDITURES	NUMBER OF LESSONS CAS ESTIMATES BASED ON	CATEGORY (JOB ANALYSIS DEVELOPMENT REVIEW)	APPLICABILITY	YEAR OF EX-PENDITURE	ITEMS	TOTAL COST (\$)	TOTAL COST 1975 (\$)	1975 PER LESSON COST (\$)
10		D	divide by 14; 1/2 in development and 1/2 in job analysis	1973	179 HRS 05; 650 HRS 03; 143 HRS E6; 71 HRS GS4	3,802.46	4,267.72	304.84
11		J		1973		3,802.46	4,267.72	304.84
12		D	divide by 14	1974	89 HRS 05; 325 HRS 03; 71 HRS E6; 35 HRS GS4	3,994.62	4,322.18	308.73
13		D	divide by 14	1972	21 HRS 06; 48 HRS 04; 127 HRS 03; 295 HRS 02; 20 HRS E5; 21 HRS E4; 21 HRS E3; 200 HRS GS12; 42 HRS GS14; 42 HRS GS3	5,289.66	6,144.69	438.91
14		D	divide by 14	1973	83 HRS 06; 193 HRS 04; 1183 HRS 02; 83 HRS E5; 84 HRS E4; 84 HRS E3; 796 HRS GS12; 170 HRS GS4; 171 HRS GS3	19,044.78	21,375.07	1,526.79
15		D	divide by 14	1974	41 HRS 06; 97 HRS 04; 253 HRS 03; 592 HRS 02; 41 HRS E5; 42 HRS E4; 42 HRS E3; 398 HRS GS12; 85 HRS GS4; 85 HRS GS3	11,955.98	12,936.37	924.03
16		D	divide by 14	1972	31 HRS 06; 71 HRS 04; 16 HRS GS4	989.29	1,149.20	82.08
17		D	divide by 14	1973	122 HRS 06; 286 HRS 04; 64 HRS GS4	4,326.06	4,855.39	346.81
18		D	divide by 14	1974	51 HRS 06; 153 HRS 04; 37 HRS GS4	2,264.74	2,450.45	175.03

Table B<sub>1</sub> (continued)

SCHOOL/EX-PENDITURES	NUMBER OF LESSONS CAS ESTIMATES BASED ON	CATEGORY (JOB ANALYSIS DEVELOPMENT REVIEW)	APPLICABILITY	YEAR OF EXPENDITURE	ITEMS	TOTAL COST (\$)	TOTAL COST 1975 (\$)	1975 PER LESSON COST (\$)
Air Defense	3							
1		D	applies to lessons produced in FY 74; divide by 21	1973	29 Days 05; per diem and travel \$1059	3,506.60	3,935.67	187.41
2		D	this is the per lesson cost	1973	5 HRS 01; 5 HRS E3	36.05	40.46	40.46
3		D	this is the per lesson cost	1974	8 HRS 01; 1 HR E6; 60 HRS E3	219.53	237.53	237.53
4		D	applies to lessons produced in FY 74 and FY 75; divide by 156	1973	\$3,800.00	24.36	27.34	27.34
5		J	this is the per lesson cost	1974	1 HR 05; 1 HR 04; 40 HRS 03; 5 HRS WO 02; 10 HRS E7; 4 HRS GS4	434.64	470.28	470.28
6		D	this is the per lesson cost	1974	1 HR 07; 1 HR 06; 3 HRS 05; 3 HRS 04; 95 HRS 03; 17 HRS 02; 16 HRS WO 02; 8 HRS GS4	1,058.79	1,145.61	1,145.61
7		D	this is the per lesson cost	1974	2 HRS @ \$6.60	13.20	14.28	14.28
8		D	this is the per lesson cost	1974	8 HRS @ \$5.50	44.00	47.61	47.61



Table B<sub>1</sub> (continued)

SCHOOL/EX-PENDITURES	NUMBER OF LESSONS CAS ESTIMATES BASED ON	CATEGORY (JOB ANALYSIS DEVELOPMENT REVIEW)	APPLICABILITY	YEAR OF EXPENDITURE	ITEMS	TOTAL COST (\$)	TOTAL COST 1975 (\$)	1975 PER LESSON COST (\$)
Artillery	7							
1		J.	divide by 7	1972	20 HRS 04; 4 HRS GS12; 4 HRS GS11	227.72	264.53	37.79
2		J	divide by 7	1972	4 HRS 05; 10 HRS 04; 80 HRS 03; 4 HRS E6; 30 HRS GS9; 8 HRS GS3	897.12	1,042.13	148.88
3		R	divide by 7	1972	10 HRS 04	79.90	92.81	13.26
4		D	divide by 7	1973	7 HRS 03; 7 HRS GS12	120.54	135.30	19.33
5		D	divide by 7	1973	40 HRS 02; 10 HRS 03; 5 HRS 01; 5 HRS E4; 3 HRS GS5; per diem and travel \$467.00	698.65	784.14	112.02
6		D	put 2/3 in 1973 and 1/3 in 1974 for inflation purposes; divide by 7	1973-74	60 HRS 04; 820 HRS 03; 80 HRS 02; 25 HRS 01; 20 HRS E6; 150 HRS E4; 50 HRS E3; 50 HRS GS11; 25 HRS GS3	8,430.34	9,349.58	1,335.65
7		R	put 2/3 in 1973 and 1/3 into 1974 for inflation purposes; divide by 7	1973-74	50 HRS 03; 40 HRS 02; 52 HRS 04; 295 HRS 03; 30 HRS 02; 30 HRS GS11; 4 HRS GS3	3,692.81	4,095.48	585.07
8		D	applies to all lessons produced in FY 74, FY 75 and FY 76; divide by 209; put 2/3 in 1973 and 1/3 in 1974 for inflation purposes	1973-74	\$32,500	32,500.00	36,043.81	172.46
9		D	divide by 7; put 2/3 in 1973 and 1/3 in 1974 for inflation purposes	1973-74	105 HRS E3; 105 HRS E4	625.80	694.03	99.15

TABLE B<sub>2a</sub> REPORTED PER LESSON DEVELOPMENT COSTS BY CATEGORY AND CAS: IN 1975 DOLLARS

SCHOOL	Development Cost Per Lesson By Development Function			
	TOTAL	JOB ANALYSIS	CURRICULUM DESIGN AND FOLLOW-THROUGH	REVIEW
Armor	5,099.20	131.01	3,129.09	1,839.10
Infantry	6,035.98	848.83	5,187.15	-
Air Defense	2,170.52	470.28	1,700.24	-
Artillery	2,523.61	186.67	1,738.61	598.33
Average (unweighted)	3,957.33	409.20	2,938.77	1,218.15*

\* average based on two CAS reports

TABLE B<sub>2b</sub> ADJUSTED PER LESSON DEVELOPMENT COSTS BY CATEGORY AND CAS: IN 1975 DOLLARS

SCHOOL	Development Cost Per Lesson By Development Function			
	TOTAL	JOB ANALYSIS	CURRICULUM DESIGN AND FOLLOW-THROUGH	REVIEW
Armor	5,099.20	131.01	3,129.09	1,839.10
Infantry	6,035.98	848.83	3,532.45	1,654.70
Air Defense	2,170.52	470.28	1,157.86	542.38
Artillery	2,523.61	186.67	1,738.61	598.33
Average (unweighted)	3,957.33	409.20	2,389.50	1,158.63

## APPENDIX C

### DEVELOPMENTAL COST AT USACATB

#### • TEC hardware team

Table C<sub>1</sub> shows TEC hardware team man year utilization figures during 1972-74 and those projected for 1975-80, by team function. Projections are based on projected lesson output (Table C<sub>7</sub>), associated equipment needs, and actual staff time utilization and travel expenditures during 1972-74. Table C<sub>2</sub> shows actual costs for staff time in 1972-74 and projections for 1975-80.

Table C<sub>2</sub> shows total team expenditures of \$463,208.52. Of this total, \$64,026.23 is for the initial selecting, testing, and contracting of equipment; \$88,059.70 is for shipping, inspecting, and repairing equipment; \$74,012.69 is for introducing equipment to Army units; \$135,110.25 is for planning and management; \$63,807.52 is for travel; and \$38,192.13 is for other costs.

To determine the hardware team cost per lesson, the most reasonable number of lessons to use appears to be the full 3,600 lessons projected (Table C<sub>7</sub>). On this basis, the hardware team cost per lesson, in 1975 dollars, is \$128.66.

#### • TEC development team

Table C<sub>4</sub> shows TEC development team man year utilization figures during 1972-74 and those projected for 1975-80, by team function. Projections are based on projected lesson output (Table C<sub>7</sub>), the phasing of TEC II, III and IV, and actual staff time utilization and travel expenditures during 1972-74. Table C<sub>5</sub> shows actual costs for staff time in 1972-74 and projections for 1975-80.

Table C<sub>5</sub> shows total team expenditures of \$1,276,752.69. Of this total, \$198,540.96 is for TEC II; \$105,302.88 is for TEC III; \$675,928.28 is for TEC IV; \$196,035.76 is for travel; and \$100,944.81 is for planning and management. If the last two categories are proportionally reallocated to TEC II, TEC III and TEC IV, the adjusted figures are \$258,828 for TEC II, \$137,377 for TEC III, and \$880,547 for TEC IV.

The overall development team cost per lesson based on the full 3,600 lessons projected is \$354.65, with the comparable per lesson costs for TEC II, TEC III and TEC IV (on the basis of the number of lessons in each) being, respectively, \$369.75, \$179.90, and \$314.84.



TABLE C<sub>1</sub> ACTUAL AND PROJECTED\* TEC HARDWARE TEAM MAN YEAR UTILIZATION, BY FUNCTION: 1972-1980

HARDWARE TEAM FUNCTION	(IN MAN YEARS)										
	1972	1973	1974	1975	1976	1977	1978	1979	1980		
Initial Selecting, Testing, and Contracting Equipment	0.85	1.19	0.14	0.15	0.12	0.12	0.12	0.12	0.36		
Shipping, Inspecting, and Repairing Equipment	-	0.19	0.70	1.50	1.20	0.50	0.06	-	-		
Introducing Equipment To Command and TASO Units and Follow-up	-	0.41	0.98	1.05	0.60	0.30	0.06	0.06	0.06		
Other TEC**	0.37	0.97	0.98	0.30	0.48	0.60	0.96	1.02	0.78		
TOTAL	1.22	2.76	2.79	3.00	2.40	2.00	1.20	1.20	1.20		

Source: USACATB

\*Projections are based on projected lesson output, equipment needs, and actual man year utilization in 1972-74.

\*\*Includes planning and management overhead for TEC system.

TABLE C<sub>2</sub> TEC HARDWARE TEAM COSTS: 1972, 1980 IN 1975 DOLLARS\*

STAFF COST: (TOTALS)	1972	1973	1974	1975	1976	1977	1978	1979	1980
1	\$17,520.69	23,364.76	2,966.77	64,082.18	50,434.95	32,041.04	24,920.71	25,514.20	25,514.21
2	-	3,803.57	14,833.84	2,966.77	2,373.41	2,373.41	2,373.41	2,373.41	7,713.60
3 (See NOTE)	-	8,150.50	20,767.37	32,041.09	25,514.16	10,880.34	1,186.70	-	-
4	7,508.87	19,017.83	20,767.37	22,547.43	12,460.40	6,526.89	1,186.70	1,186.70	1,186.70
TRAVEL COST**	-	531.28	21,044.34	6,526.89	10,086.99	12,460.40	20,173.90	21,954.09	16,613.91
OTHER COST**	-	5,611.79	7,303.50	12,162.80	9,572.56	6,081.39	4,729.95	4,842.60	4,842.60
TOTAL COST	\$25,029.56	60,479.73	87,683.19	83,524.72	65,736.93	41,762.29	32,481.65	33,255.22	33,255.23
									463,208.52

Total staff costs '73 & '74 = \$113,672.01  
 Travel costs = 21,575.62 = 18.98%  
 Other costs = 12,915.29 = 11.36%

Source: USCATB

\* AR 37-13, Economic Analysis and Program Evaluation of Resource Management, April, 1973 recommends that a 10% discount rate be applied to future costs in order that they may be assessed in present-day terms. Inflation factors must also be introduced which exert an effect opposite to that of the discounting factors. To allow for the effects of these forces, RBS consulted the principal author of AR 37-13 to discuss the problem. In 1974 the annual inflation rate was in excess of 10%. Monetary and fiscal policy has been directed to reducing this rate. To RBS it seems reasonable, given the uncertainty over future inflation rates, to assume that these two forces--present value discounting and inflation--can appropriately be viewed as canceling each other out (at the 10% rate level).

\*\* Travel and other costs are projected for the period 1975-80 on the basis of their ratio to staff time costs in 1973 and 1974.

NOTE: The numbers 1-4 refer to the hardware team functions listed in Table C<sub>1</sub>.

TABLE C<sub>3</sub> TEC HARDWARE TEAM STAFF TIME COSTS:<sup>\*</sup> 1972-1974 IN 1975 DOLLARS

GRADE	MAN MONTHS			COST IN 1975 DOLLARS
	1972	1973	1974	
05	-	1.275	0.450	3,679.91
05	4.550	7.800	7.800	43,155.22
05	1.890	1.350	-	6,398.19
04	2.100	4.200	4.200	18,569.28
04	-	0.750	6.000	12,901.26
04	4.125	6.750	-	17,947.95
03	2.000	6.000	6.000	21,280.86
E7	-	2.000	6.000	9,137.78
E6	-	3.000	3.000	5,631.12
Total				138,701.57

Source: USACATB

<sup>\*</sup>Included in this table are staff time costs for (1) initial selecting, testing, and contracting equipment, (2) shipping, inspecting, and repairing equipment, (3) introducing equipment to command and TASSO units and follow-up, and (4) other TEC planning and management functions.



TABLE C<sub>4</sub> ACTUAL AND PROJECTED\* TEC DEVELOPMENT TEAM MAN YEAR UTILIZATION, BY FUNCTION 1972-1980

DEVELOPMENT TEAM FUNCTION	( IN MAN YEARS )									
	1972	1973	1974	1975	1976	1977	1978	1979	1980	
TEC II	-	1.73	4.00	2.80	0.40	-	-	-	-	
TEC III	-	1.38	1.20	2.00	0.20	-	-	-	-	
TEC IV	-	-	1.40	2.40	6.00	6.00	6.00	4.00	4.00	
OTHER TEC**	1.29	1.73	1.20	1.20	1.20	0.80	0.80	0.40	0.40	
TOTAL	1.29	4.84	7.80	8.40	7.80	6.80	6.80	4.40	4.40	

Source:- USACATB

\*Projections are based on projected lesson output and actual man year utilization in 1972-74.

\*\*Includes contracting, end process reviews and planning and management overhead for TEC system.

TABLE C<sub>5</sub> TEC DEVELOPMENT TEAM COSTS: 1972-1980 IN 1975 DOLLARS<sup>a</sup>

STAFF COST:	1972	1973	1974	1975	1976	1977	1978	1979	1980
TEC II	-	35,229.43	90,728.63	190,530.12	176,920.82	154,238.67	154,238.67	99,801.50	99,801.50
TEC III	-	28,183.54	27,218.59	63,510.04	9,072.86	-	-	-	-
TEC IV	-	-	31,755.02	45,364.32	4,536.43	-	-	-	-
OTHER TEC	24,713.36	35,299.43	27,218.59	54,437.18	136,092.94	136,092.94	136,092.94	90,728.63	90,728.63
TRAVEL COST**	-	11,936.28	12,224.44	27,218.59	27,218.59	18,145.73	18,145.73	9,072.87	9,072.87
TOTAL COST	\$24,713.36	110,578.68	189,145.27	207,239.61	192,436.78	167,765.40	167,765.40	108,554.09	108,554.09
									1,276,752.69

Source: USACAT B

<sup>a</sup> AR 37-13, Economic Analysis and Program Evaluation of Resource Management, April, 1973 recommends that a 10% discount rate be applied to future costs in order that they may be assessed in present-day terms. Inflation factors must also be introduced which exert an effect opposite to that of the discounting factors. To allow for the effects of these forces, RBS consulted the principal author of AR 37-13 to discuss the problem. In 1974 the annual inflation rate was in excess of 10%. Monetary and fiscal policy has been directed to reducing this rate. To RBS it seems reasonable, given the uncertainty over future inflation rates, to assume that these two forces--present value discounting and inflation--can appropriately be viewed as canceling each other out (at the 10% rate level).

<sup>\*\*</sup> Travel costs are projected for period 1975-1980 first on the basis of their ratio to staff time costs for TEC II in 1973 and 1974 and then on the basis of the ratio of TEC II staff time costs to total staff time costs for the period 1975-80.

TABLE C<sub>6</sub> TEC DEVELOPMENT TEAM STAFF TIME COSTS FOR TEC II  
AND OTHER TEC FUNCTIONS: \* 1972-1974 IN 1975 DOLLARS

GRADE	MAN MONTHS			COST IN 1975 DOLLARS
	1972	1973	1974	
05	-	3.30	6.60	22,353.38
04	3.90	7.80	7.80	34,485.78
04	2.55	10.20	10.20	41,017.90
04	-	-	7.20	13,968.72
04	4.50	9.00	-	22,331.03
04	4.50	9.00	-	22,331.03
03	-	1.30	7.80	14,822.80
03	-	-	3.60	5,982.05
03	-	-	1.75	2,907.94
03	-	0.90	1.80	4,280.32
E7	-	-	1.20	1,419.90
TOTAL				185,900.85

Source: USACATB

\* Included in this table are staff time costs for TEC II and other TEC functions including planning and management overhead.



TABLE C<sub>7</sub> PROJECTED CUMULATIVE NUMBER OF TEC LESSONS  
PRODUCED: FY 76 - FY 80

LESSON CATEGORY	FISCAL YEAR				
	1976	1977	1978	1979	1980
TEC II	700*	700	700	700	700
TEC III	115	115	115	115	115
TEC IV	395	1,000	1,600	2,200	2,800
TOTAL	1,200	1,800	2,400	3,000	3,600

Source: USACATB

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\* USACATB projects 200 TEC II lessons for use by an infantry battalion.

## APPENDIX D

### CONTRACTOR COSTS PER LESSON, EXCLUDING ANSWER PRINT

As of January 22, 1975, USACATB was able to provide contractor costs for 34 lessons. Narration costs were not available for the six lessons in the 043-441 series. These costs were estimated by multiplying the costs without narration by a factor of 1.1 which seemed reasonable to USACATB.

Of the 34 lessons, only the six lessons in the 250-061 series have been approved. Costs for the other 28 lessons represent contractor billing figures and thus are subject to Army approval.

Table D<sub>1</sub> provides lesson identification numbers, cost estimates, and costs converted to 1975 dollars. Total costs estimated for the 34 lessons are \$359,766.48 with a cost per lesson of \$10,581.66.

TABLE D<sub>1</sub> TEC II LESSON COSTS FOR 34 COMPLETED LESSONS: IN 1975 DOLLARS

<u>TEC II COMPLETED 1974 LESSON</u>	<u>CONTRACTOR COST (\$) *</u>	<u>CONTRACTOR COST IN 1975 DOLLARS</u>
250-061-6301	5,000**	5,410.00
6302	3,000**	3,246.00
6303	4,800**	5,193.60
6304	4,800**	5,193.60
6305	5,400**	5,842.80
6306	4,700**	5,085.40
010-071-6601	14,900	16,121.80
6602	15,100	16,338.20
6603	10,300	11,144.60
6604	13,600	14,715.20
6605	10,800	11,685.60
6606	12,300	13,308.60
6607	10,300	11,144.60
6608	11,600	12,551.20
6609	10,000	10,820.00
043-441-5901	7,370***	7,974.34
5903	8,800***	9,521.60
5904	7,040***	7,617.28
5918	9,130***	9,878.66
5931	9,020***	9,759.64
5932	5,720***	6,189.04
020-171-5331	15,200	16,446.40
5332	12,100	13,092.20
5352	17,400	18,826.80
5353	15,900	17,203.80
5354	7,400	8,006.80
5346	11,600	12,551.20
5347	9,900	10,711.80
5348	11,400	12,334.80
5366	16,200	17,528.40
5367	13,100	14,174.20
5368	11,000	11,902.00
5369	11,800	12,767.60
5370	8,900	9,629.80
Total: \$359,766.48		Per lesson cost: \$10,581.66

\* Rounded to the nearest \$100.

\*\* Actual approved costs. Contractor costs for other lessons are billing figures from the contractor which have not yet been approved.

\*\*\* Narration costs for the 043-441 series lessons were included by increasing the cost without narration by a factor of 10%. (All other figures include actual narration costs.)

Source: USACATB



## APPENDIX E

### LESSON MASTER COST

Table E<sub>1</sub> provides the following information for 21 lessons: lesson identification number, initial production run quantity ( $Q_1$ ), total initial order cost--including both answer print cost and reproduction costs ( $C_1$ ), reorder cost per lesson ( $L_2$ ), estimated cost of lessons only ( $L_2 \times Q_1$ ) in the total initial order cost ( $C_1$ ), and estimated cost of the answer print alone (A).

The assumption followed to separate the answer print cost (A) from the total cost of the initial order ( $C_1$ ) was that the production quantities for both orders (initial and reorder) were such that lesson reproduction costs were the same.

The procedure then was:

1. Identify  $L_2$
2. Multiply  $L_2$  by  $Q_1$
3. Subtract the product  $L_2 Q_1$  from  $C_1$  to provide an estimate of A.

Total answer print costs for the 21 lessons were \$15,816.20 in 1974 dollars. In 1975 dollars, the mean answer print cost was \$814.91.

TABLE E<sub>1</sub> ESTIMATION OF ANSWER PRINT COSTS: IN 1975 DOLLARS

LESSON #1	INITIAL PRODUCTION RUN $Q_1$	COST OF ORDER $C_1$	REORDER COST/ LESSON $L_2$	COST OF LESSONS $L_2 \times Q_1$	COST OF ANSWER PRINT A
948-071-0005-F	1200	4,955.82	3.87	4,464	491.82
948-071-0006-F	1200	6,168.68	4.30	5,160	1,008.68
939-071-0009-F	1200	5,236.68	3.87	4,644	592.68
939-071-0010-F	1200	5,219.62	3.87	4,644	575.62
939-071-0011-F	1200	4,984.53	3.87	4,644	340.53
939-071-0012-F	1200	4,968.40	3.87	4,644	324.40
949-061-0001-F	1200	5,904.00	3.87	4,644	1,260.00
942-071-0002-F	1200	5,097.87	3.87	4,644	453.87
949-061-0003-F	1200	5,488.19	3.87	4,644	844.19
010-071-6601-F	675	4,460.00	4.59	3,098.25	1,361.75
010-071-6602-F	675	4,967.46	5.02	3,388.50	1,578.96
010-071-6603-F	675	3,608.63	4.59	3,098.25	510.38
010-071-6604-F	675	3,821.02	4.59	3,098.25	722.77
010-071-6605-F	675	3,763.13	4.59	3,098.25	664.88
250-061-6301-F	600	3,228.78	4.09	2,454	774.78
250-061-6302-F	600	2,976.40	3.98	2,388	588.40
250-061-6603-F	600	3,527.20	4.41	2,646	881.20
250-061-6304-F	600	3,275.21	4.09	2,454	821.21
250-061-6305-F	600	3,458.15	4.52	2,712	746.15
250-061-6306-F	600	3,464.96	4.52	2,712	752.96
250-061-6307-F	600	2,872.97	3.92	2,352	520.97
Total					\$15,816.20

Source: USACATB

## APPENDIX F

### REVIEW COSTS

The information provided by USACATB indicated that review at NTEC involved about half a day per lesson for a GS12. At DCAS, review required about three hours for a GS11.

Thus, review costs on a per lesson basis, in 1975 dollars, are \$44.75 for NTEC and \$28.14 for DCAS. Total review cost per lesson is \$72.89.



## APPENDIX G

### DISTRIBUTION COSTS

#### • Storage

TOAD reported that TEC lessons could be stored in two alternative ways. The cost per 1000 lessons for the less expensive storage approach is \$3.14 or a cost of \$0.003 per lesson, in 1975 dollars.

#### • Handling service

Data were obtained from TOAD on the handling costs for 2957 boxes of TEC II lessons shipped during the period June to November 1974.

Table G<sub>1</sub> shows staff time, hourly wage rates (with and without benefits), and a total cost of \$12,670, in 1975 dollars.

The mean number of TEC lessons per box, based on shipping figures from TOAD, is 3.81. In all, TOAD shipped 11,266 lessons at a cost per lesson, in 1975 dollars, of \$1.13.

#### • Shipping

Costs of shipping TEC lessons from TOAD to various Army posts during the period June to November 1974 averaged \$1.25 per box. Again, since there are approximately 3.81 lessons per box, the shipping cost per lesson averaged \$0.36, in 1975 dollars.

TABLE G<sub>1</sub>

TOBYHANNA WAGE FIGURES FOR HANDLING SERVICE COSTS: IN 1975 DOLLARS

<u>CATEGORY</u>	<u>HOURS</u>	<u>COST/HR \$</u>	<u>COST/HR \$ IN- CLUDING FRINGE</u>	<u>1975 TOTAL COST \$</u>
WB 4	798.0	4.359	4.716	3,895
WB 8	865.5	5.173	5.597	5,013
GS 3	865.5	3.882	4.200	3,762
Total				\$12,670

Source: TOAD

## APPENDIX H

### PROCUREMENT AND FLOAT FOR LESSONS AND EQUIPMENT

This appendix summarizes TEC procurement and float costs for equipment and lessons on a battalion basis for one year of operation.

#### ● Equipment procurement for a battalion

1. Assume that an average of 50 minutes of instructional time is required for each lesson. This assumption is discussed in the section that compares TEC trainee time requirements to those of conventional group instruction.
2. One hundred lessons require 5000 minutes per man and 2,665,000 minutes for 533 men. This is equal to 44,417 instructional hours per year.
3. One Beseler CUE/SEE operating for 8 hours a day for 250 days each year provides 2000 hours of instruction.
4. Assuming that men do not pre-test out of the lessons and that the equipment is in continuous operation, 22 Beselers will be needed to provide the instruction.
5. The cost of Beselers is  $(\$489.07 \times 22) / 6^* = \$1,793.26$  per year.
6. Current BOI guidelines allow 8 Beselers and 4 cassette tape players per battalion. Assuming the same ratio for cassette players as for Beselers, 11 cassette players would be required.\*\*
7. The cost of cassette tape players, assuming the same instructional factors as for the Beseler, is  $(\$52.66 \times 11) / 6^* = \$96.54$  per year.
8. Total annual equipment procurement cost per battalion is \$1,889.80.

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\* AR 108-1, Figure 2-11, specifies a life expectancy of six years for portable audiovisual equipment. A six year amortization factor has, therefore, been applied to both types of equipment.

\*\* This estimate results from applying the ratio of 22:8 (as an underestimation factor) to the number of cassette players indicated in the BOI guidelines.

● Equipment float requirements on a per battalion basis

1. TASO maintains a 10% float for both pieces of equipment.\*
2. Therefore, TASO would store 2.2 Beseler CUE/SEE and 1.1 cassette tape players.
3. This cost is  $[\$489.07 \times 2.2 + \$52.66 \times 1.1] / 6 = \$188.98$  per year.
4. TASO receives one Beseler repair kit for each 10 Beseler machines. A repair kit is assumed to last for one year and costs \$16.75. The repair kit cost per battalion is  $\$16.75 \times 24.2 \times 10\% = \$40.54$  per year.
5. TASO also receives one Beseler maintenance manual. Assuming that each TASO services about two divisions on a post and each division is made up of the equivalent of 18 infantry battalions, the maintenance manual cost per battalion is  $\$3.00 / 36 = \$0.08$ . A manual is assumed to last for one year.
6. The post maintenance unit receives one maintenance manual and, by following the same assumptions that applied to TASO, this cost per battalion is also \$0.08.
7. The total equipment float (excluding shipping which is computed below) is \$229.68 per year.

● Equipment shipping costs on a per battalion basis

1. The mean shipping cost for a Beseler CUE/SEE is \$8.42. (See Table H<sub>1</sub>.)
2. Each battalion received 22 Beselers<sup>\*\*</sup> at a total<sup>\*\*\*</sup> shipping cost of  $(\$8.42 \times 22) / 6 = \$30.87$  per year.

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\* TEC Management & Maintenance Instructions. Test Edition, TC 21-53, p. 16.

\*\* Beseler equipment that must be shipped back to the manufacturer is presently covered by a 90 day warranty included in the price. Related shipping costs are also included. A long-term warranty agreement is being considered by USACATB

\*\*\* All shipping costs for equipment have been amortized over the six year life expectancy estimated for the equipment itself.



3. Each battalion received 11 cassette tape players. Data on shipping costs were not available. Assuming that the shipping cost is in proportion to the equipment value, the shipping cost for a cassette tape player is

$$\frac{\$52.66}{\$489.07} = \frac{X}{\$8.42} = \$0.91$$

The cost of shipping 11 cassette tape players is  $(\$0.91 \times 11)/6 = \$1.67$  per year.

4. TASO float shipping costs are

$$[\$8.42 \times 2.2 + \$0.91 \times 1.1]/6 = \$3.25 \text{ per year.}$$

• Lesson cassette procurement costs per battalion

1. Previously in this appendix, it was noted that the present BOI for equipment was understated by a factor of 2.75 given the requirement to provide 44,417 hours of instruction per year.
2. The most reasonable way to estimate lesson cassette quantities, it appears, is to apply the 2.75 factor to the present BOI.
3. The present BOI is one copy of each lesson to each battalion. USACATB projects 315 TEC II and TEC III lessons for an infantry battalion.\* When the 2.75 factor is applied to the 315 lessons, the number of cassettes is 866.
4. A study conducted by Technicolor, Inc., based on 15 years' experience, indicated that 3000 showings of a lesson cassette is a reasonable average. A second consideration is lesson revision which is treated in the section on the effects of doctrinal change. A lesson would be revised, depending on a great many factors, approximately every three years. For purposes of estimation, it is assumed that each cassette will last for two years.\*\*

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\*Ibid., p. 15

\*\* USACATB is now conducting tests to make their own determination of this factor.

5. The average estimated procurement cost per lesson is \$4.54. The annual cost per battalion is  $(\$4.54 \times 315 \times 2.75) / 2 = \$1,966.39$  per year.

● Lesson float costs per battalion

1. TASO maintains one copy of each lesson. By applying the 36 battalion base, the lesson float cost is  $(\$4.54 \times 315) / (2 \times 36) = \$19.86$ .
2. TOAD maintains a 10% lesson float. Its float per battalion is  $(\$4.54 \times 315 \times 2.75 \times 10\%) / 2 = \$196.64$ .
3. The total lesson float cost is \$216.50 per year.

In summary, the annual per battalion costs calculated in this section are:

equipment procurement and shipping	\$1,922.34 .
equipment float procurement and shipping	232.93
lesson cassette procurement*	1,966.39
lesson float	216.50

While the foregoing costs have been derived within the logic of this appendix, the separate cost factors are used for two different cost categories in the main section of this report. Thus, no total is provided here.

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\* Lesson shipping costs were provided in Appendix G.

TABLE H<sub>1</sub> BESELER CUE/SEE MEAN SHIPPING COSTS  
TO FOUR POSTS: IN 1975 DOLLARS

<u>Post</u>	<u>Number of Beselers</u>	<u>Rate (\$) per 100 pounds</u>	<u>Total (\$) Shipping Cost</u>
Fort Benjamin Harrison	103	38.85	2,030.90
Fort Knox	39	36.55	783.99
Fort Carson	141	3.50	271.42
Fort Lewis	151	3.50	290.67

Source: USACATB

TABLE H<sub>2</sub> TEC EQUIPMENT DISTRIBUTION AND FLOAT BOI

	<u>BESELER CUE/SEE</u>	<u>CASSETTE TAPE PLAYER*</u>	<u>BESELER REPAIR KITS</u>	<u>MAINTENANCE MANUAL</u>
TASO/AVSC	10%	10%	1 for each 10 Beseler CUE/SEE's	1
Battalion	8	4	-	-
Post maintenance unit	-	-	-	1

Source: USACATB

\* Since only a few audio-only lessons have been completed to date, current distribution of cassette tape players is lower than indicated in this table.

TABLE H<sub>3</sub> TEC LESSON DISTRIBUTION AND FLOAT BOI

	<u>COPIES COMMON</u>	<u>BRANCH/MOS</u>	<u>CRITICAL DUTY POSITIONS</u>
TOAD	10%	10%	10%
TASO/AVSC	2	2	2
Battalion	1	1	1

Source: USACATB



## APPENDIX I

### ANNUAL ADMINISTRATIVE SUPPORT COST

Table I<sub>1</sub> provides a summary of costs for TEC managers, supervisors, training maintenance, and learning center adaptations for all of the Army sites included in the cost-effectiveness study. Only rows 1, 2, 4 and 5 in Table I<sub>1</sub> were judged to contain comparable battalion data. While all reported data are shown, only information from rows 1, 2, 4 and 5 were included in the analysis of TEC administrative costs. Tables I<sub>2a</sub> to I<sub>2d</sub> provide the detailed information reported.

Since administrative support is the cost category under discussion, only the costs of TEC managers, supervisors and TASO maintenance are included in the summary figure. While learning center facility costs are calculated, they are included as part of the start-up cost category.

The cost information reported, when converted to 1975 dollars, shows \$1,301.88 for TEC managers, \$4,807.98 for TEC supervisors, and \$1,969.95 for TASO maintenance. By applying the 2.75 factor (derived in Appendix H) to adjust present activity levels to a comparison module base, the average annual estimated cost per battalion for administrative support is \$22,219.48.

Each component figure was calculated by adding the costs in rows 1, 2, 4 and 5 and dividing by seven (since seven battalions reported the costs in rows 1, 2, 4 and 5).

The costs to adapt learning center facilities for TEC use were obtained by adding the figures in rows 1, 2, 4 and 5 and dividing by six (since it is assumed that the facility adaptations have the same economic life as the Beseler CUE/SEE), then by 2 (since two battalions reported costs), and finally multiplying by the 2.75 factor. The average annual estimated cost per battalion for learning center facility adaptation is \$365.31.

TABLE I<sub>1</sub> SUMMARY OF ADMINISTRATIVE SUPPORT  
AND OPERATIONAL TRAINING COSTS FOR TEC

TRAINING UNIT IDENTIFICATION	\$ FOR TEC MANAGERS	\$ FOR TEC SUPERVISORS	\$ FOR TEC TRAINING	\$ FOR TEC MAINTENANCE	\$ FOR LEARNING CENTER REQUIREMENTS	TOTAL
#1: 4TH DIV., 1/11 INF. & 1/12 INF. FT. CARSON	2,111.71	4,772.58	4,219.40	1,742.62	0	12,846.31
#2: 4TH DIV., 1/19, 1/29, & 2/20 FA FT. CARSON	3,269.43	2,654.82	1,798.25	0	0	7,722.50
#3: 9TH INF. DIV., 1ST SIG. GP., 58TH BN. FT. LEWIS	4,851.45	12,493.25	14,179.45	12,605.25	15,281.82	59,411.22
#4: 9TH INF. DIV., 2/1 INF. FT. LEWIS	3,363.45	20,933.60	13,529.65	12,047.03	867.62	50,741.35
#5: 9TH INF. DIV., 2/2 INF. FT. LEWIS	368.58	5,294.88	6,068.78	0	672.40	12,404.64
#6: 9TH INF. DIV., 3RD BDE. FT. LEWIS	7,371.60	9,168.00	7,367.40	0	459.80	24,366.80
#7: 38TH N.G., 152ND INF. TELL CITY	4,926.30	18,429.00	12,092.15	1,547.00	1,390.40	38,384.85
#8: 38TH N.G., 152ND INF. MARTINSVILLE	20,870.52	6,210.30	10,602.30	2,304.94	15,712.00	55,700.06
#9: 38TH N.G. CINCINNATI	2,689.50	0	3,318.30	0	954.00	6,961.80
#10: 38TH N.G. BIG RAPIDS	989.33	36,864.05	4,746.15	1,183.80	872.58	44,655.91
TOTAL	50,811.87	116,820.48	77,921.83	31,430.64	36,210.62	313,195.44

Source: Interviews Conducted by ARI Staff  
November and December 1974

TABLE I<sub>2a</sub> COSTS OF ADMINISTRATIVE SUPPORT AND OPERATIONAL TRAINING FOR TEC BY BATTALION: IN 1975 DOLLARS

4TH DIV., 1/11 & 1/12 INF. TRAINING UNIT: FT. CARSON, COLORADO									
COST CATEGORIES	LOCATION	GRADE	TIME (\$)	PAY RATE	\$	ADDITIONAL \$	TOTAL	NOTE	
A. TEC MANAGERS	BDE	E-9	5	18,216	910.80				
	BN	O-5	1.5	26,177	392.66				
	BN	O-5	1	26,177	261.77				
	BN	E-9	3	18,216	546.48		2,111.71		
B. TEC SUPERVISORS	CO/BN	O-3	10	18,429	1,842.90				
	CO/BN	O-2	5	14,558	727.90				
	CO	E-8	7.5	15,417	1,156.28				
	CO	O-3	3	18,429	552.87				
	CO	O-3	1	18,429	184.29				
	CO	E-8	2	15,417	308.34		4,772.58		
	CO	E-7	5	13,123	656.15				
C. TEC TRAINING	CO	E-6	5	11,109	555.45				
	CO	O-1	3	10,444	313.32				
	CO	O-2	7.5	14,558	1,091.85				
	CO	E-5	10	9,401	940.10				
	CO	E-3	5	6,937	346.85				
	CO	E-4	4	7,892	315.68		4,219.40		
	TASO	GS-9	3	15,781	473.43			The maintenance expenses reported here are to be prorated to all Ft. Carson TEC training units.	
	TASO	GS-7	1	12,449	124.49				
D. TEC MAINTENANCE	TASO	GS-7	5	12,449	622.45		1,742.62		
	TASO	GS-5	5	10,445	522.25				
	E. LEARNING CENTER REQUIREMENTS						0	No additional costs are reported here.	

Source: Interviews Conducted by ARI Staff  
November and December 1974



TABLE I. <sub>2b</sub> COSTS OF ADMINISTRATIVE SUPPORT AND OPERATIONAL TRAINING FOR TEC BY BATTALION: IN 1975 DOLLARS

4TH DIV., 1/19, 1/29 & 2/20 FA TRAINING UNIT: FT. CARSON, COLORADO									
COST CATEGORIES	LOCATION	GRADE	TIME (%)	PAY RATE	\$	ADDITIONAL \$	TOTAL	NOTE	
A. TEC MANAGERS	BDE	E-9	1	18,216	182.16				
	BN	0-5	1	26,177	261.77				
	BN	0-5	2	26,177	523.54				
	BN	E-9	1	18,216	182.16				
	BN/BTRY/BDE	0-4	3	21,516	645.48				
	BTRY	0-3	3	18,429	552.87				
	BTRY	0-3	5	18,429	921.45		3,269.43		
B. TEC SUPERVISORS	BTRY	E-8	2	15,417	308.34				
	BTRY	0-1	5	10,444	522.20				
	BTRY	E-8	5	15,417	770.85				
	BTRY	E-7	3	13,123	393.69				
	BTRY	0-3	2	18,429	368.58				
	BTRY	0-2	2	14,558	291.16		2,654.82		
C. TEC TRAINING	BTRY	E-6	4	11,109	444.36				
	BTRY	E-5	2	9,401	188.02				
	BTRY	0-1	4	10,444	417.76				
	BTRY	0-1	1.5	10,444	156.66				
	BTRY	E-7	1.5	13,123	196.85				
	BTRY	E-4	5	7,892	394.60		1,798.25		
D. TEC MAINTENANCE							See Ft. Carson 1/11th Inf. & 1/12th Inf. TBC Maintenance		
							0		
E. LEARNING CENTER REQUIREMENTS									
							0	See Ft. Carson 1/11th Inf. & 1/12th Inf. Learning Center Requirements	

Source: Interviews Conducted by ARI Staff.  
November and December 1974

TABLE I<sub>2c</sub> COSTS OF ADMINISTRATIVE SUPPORT AND OPERATIONAL TRAINING FOR TEC BY BATTALION: IN 1975 DOLLARS

9TH INF. DIV., 2/1ST INF. FT. LEWIS									
TRAINING UNIT:									
COST CATEGORIES	LOCATION	GRADE	TIME (\$)	PAY RATE	\$	ADDITIONAL \$	TOTAL	NOTE	
A. TEC MANAGERS	BN	E-9	7.5	18,216	1,366.20				
	BN	0-4	5	21,516	1,075.80				
	BN	0-3	5	18,429	921.45		3,363.45		
B. TEC SUPERVISORS	BN	E-9	35	18,216	6,375.60				
	CO	0-2	25	14,558	3,639.50				
	CO	0-2	25	14,558	3,639.50				
	CO	0-2	25	14,558	3,639.50				
	CO	0-2	25	14,558	3,639.50		20,933.60		
C. TEC TRAINING	CO	E-7	5	13,123	656.15				
	CO/BN	E-6	25	11,109	2,777.25				
	CO/BN	E-6	25	11,109	2,777.25				
	CO/BN	E-4	20	7,892	1,578.40				
	CO/BN	E-4	20	7,892	1,578.40				
	CO/BN	E-3	20	6,937	1,387.40				
	CO/BN	E-3	20	6,937	1,387.40				
	CO/BN	E-3	20	6,937	1,387.40		13,529.65		
	TASO	GS-7	12.5	12,449	1,556.13			This cost is shared with Ft. Lewis 2/2 INF. and 3RD BDE.	
	TASO	GS-7	12.5	12,449	1,556.13				
D. TEC MAINTENANCE	TASO	GS-5	12.5	10,445	1,305.63				
	TASO	GS-5	12.5	10,445	1,305.63				
	TASO	GS-9	12.5	15,781	1,972.63				
	TASO	GS-9	12.5	15,781	1,972.63				
	TASO	GS-11	12.5	19,026	2,378.25		12,047.03		
	TASO	GS-11	12.5	19,026	2,378.25				
	TASO	GS-11	12.5	19,026	2,378.25				
	TASO	GS-11	12.5	19,026	2,378.25				
	TASO	GS-11	12.5	19,026	2,378.25				
	TASO	GS-11	12.5	19,026	2,378.25				
E. LEARNING CENTER REQUIREMENTS	ITEM								
	(2) Carrels 42"	E-8	25 HRS	15,417 (7.41/HR)	185.25				
	(2) Carrels 36"	E-8	45 HRS	15,417 (7.41/HR)	333.45				
	Lumber for Carrels				260.00				
	(6) Parti-tions	E-8	4 HRS	15,417	29.64				
		E-8	8 HRS	15,417	59.28		867.62		

Source: Interviews Conducted by ARI staff November and December 1974

TABLE I<sub>2d</sub> COSTS OF ADMINISTRATIVE SUPPORT AND OPERATIONAL TRAINING FOR TEC BY BATTALION: IN 1975 DOLLARS

9TH INF. DIV., 2/2 INF.									
TRAINING UNIT: FT. LEWIS									
COST CATEGORIES	LOCATION	GRADE	TIME (\$)	PAY RATE	\$	ADDITIONAL \$	TOTAL	NOTE	
A. TEC MANAGERS	OO	0-3	2	18,429	368.58		368.58		
B. TEC SUPERVISORS	OO	0-3	10	18,429	1,842.90				
	OO	E-8	20	15,417	3,083.40		5,294.88		
C. TEC TRAINING	OO/BN	E-7	10	13,123	1,312.30				
	OO/BN	E-7	10	13,123	1,312.30				
	OO	E-6	7.5	11,109	833.18				
	OO	0-1	15	10,444	1,566.60				
	OO	0-1	10	10,444	1,044.40		6,068.78	Provided by TASO (See 2/1 INF.)	
D. TEC MAINTENANCE							0		
E. LEARNING CENTER REQUIREMENTS	ITEM								
	Carrels (8) 36"	E-7	40 HRS (6.31/HR)	13,123	252.40	120.00 (\$15/carrel)	372.40		
	Furniture				0		0	Salvaged	
	Elec. Modifications				300		300		
							<u>672.40</u>		

Source: Interviews Conducted by ARI Staff  
November and December 1974



## APPENDIX J

### ANNUAL COST OF PROVIDING INSTRUCTIONAL SUPPORT

Instructional support costs for seven battalions from Fort Carson and Fort Lewis were calculated by applying percentage estimates to annual salaries. Rows 1, 2, 4 and 5 of Table I<sub>1</sub> show these figures in the column labeled dollars for TEC training.

The reported annual per battalion cost of instructional support, in 1975 dollars, is \$3,659.44. This figure has, it should be noted, variable components. Three battalions at Fort Carson reported a mean support cost of \$599.42 while one battalion at Fort Lewis reported total support costs of \$13,529.65. More experience in providing TEC instruction is needed before more precise cost estimates can be calculated.

The cost per battalion for instructional support was estimated by increasing the average current costs per battalion by the 2.75 factor derived earlier. The average adjusted cost per battalion is  $\$3,659.44 \times 2.75 = \$10,063.46$  per year.

## APPENDIX K

### COST OF INSTRUCTOR PREPARATION TIME, INSTRUCTOR CLASS TIME, AND SUPPORT TIME FOR CONVENTIONAL GROUP INSTRUCTION

This appendix describes the procedures used to calculate an annual per battalion estimate of instructional costs.

Table K<sub>1</sub> shows costs related to instructor preparation time, instructor class time, and support time for the instructor based on 10 conventional group instruction cases. Per lesson per soldier costs are for comparable TEC lesson instructional objectives.

1. The last column in Table K<sub>1</sub> shows that the average cost per comparable lesson per soldier for the 127 soldiers instructed during the effectiveness testing conducted by ARI was \$1.48.
2. ARI has advised, however, that a more typical class size is 20 men. The average cost per lesson per soldier, therefore, was recalculated based on a typical class size of 20.
3. The total cost for 38 lesson areas was \$678.09. The adjusted average cost per lesson per man is  
$$\$678.09 / 38 \text{ lessons} \times 20 \text{ men} = \$0.89.$$
4. Now it is necessary to apply the average cost calculated above to the instructional requirements defined in the comparison module. On this basis, the cost per battalion is  
$$533 \text{ men} \times 100 \text{ lessons} \times \$0.89 = \$47,437 \text{ per year.}$$

TABLE K<sub>1</sub> COSTS OF PREPARATION TIME, CLASS TIME, AND INSTRUCTIONAL SUPPORT TIME  
FOR 10 CONVENTIONAL GROUP INSTRUCTION CASES FOR CONTENT COMPARABLE TO TEC LESSONS: IN 1975 DOLLARS

CONVENTIONAL GROUP CASE	COMPARABLE TEC LESSON NUMBER BASE	NUMBER OF TRAINEES	INSTRUCTOR CLASS PREPARATION TIME COST (1975 DOLLARS)	INSTRUCTOR CLASS TIME COST (1975 DOLLARS)	SUPPORT TIME FOR INSTRUCTOR COST (IN 1975 DOLLARS)	TOTAL (IN 1975 DOLLARS)
1	4	17	9.47	34.75	21.90	66.12
2	6	10	10.68	25.67	15.13	51.48
3	5	8	35.00	31.50	62.78	129.28
4	5	10	22.15	53.16	22.80	98.11
5	2	10	12.62	15.78	19.89	48.29
6	2	20	22.59	10.04	37.77	70.40
7	3	20	22.60	10.17	12.40	45.17
8	3	10	21.00	14.00	10.67	45.67
9	4	7	20.04	5.01	30.04	55.09
10	4	15	28.25	10.17	30.06	68.48
Average per lesson per soldier cost						\$ 1.48
				\$ 0.42	\$ 0.53	

Source: ARI/HRI, Fort Benning



## APPENDIX L

### TRAINEE TIME FOR TEC AND CONVENTIONAL GROUP INSTRUCTION

ARI staff observed TEC instruction while testing was being conducted as part of the effectiveness study. Included were sites at Fort Carson, Fort Lewis, and four 38TH National Guard locations. Fifteen sessions, covering instruction on LAW, Grenades, Survey Firing Chart, 81mm FDC, and M16A1, were observed.

ARI staff also observed conventional group instruction in similar instructional settings at the same sites. Ten sessions, covering the same instructional objectives as those included in the TEC lessons, were observed.

Tables  $L_1$  and  $L_2$  present the data. The mean time per lesson for TEC was 55 minutes and a comparable figure for conventional group instruction was 53 minutes. Table  $L_3$  presents a comparison between the data.

During TEC instruction, trainees were not permitted to pre-test\* out of the lessons since they were tested in group settings. Thus, the reported time estimates represent group figures rather than time estimates for individual soldiers.

For conventional group instruction, the sample of 10 classes is somewhat small because a great deal of variability was observed in those lesson content areas where more than one figure is available, e.g., the M16A1 groups.

While the two time estimates have been treated as equal, an overall mean of 50 minutes per lesson was used for the TEC time estimates since it is likely that the TEC trainee time was overestimated.

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\* A feature of TEC instruction under actual operational conditions.

TABLE L<sub>1</sub>. TEC TRAINEE TIME FOR 15 CASE INSTANCES: IN MINUTES

TEC	LAW <sup>a</sup>	GRENADES <sup>**</sup>	SURVEY FIRING CHART <sup>***</sup>	81mm FDC <sup>****</sup>	MI6A1 <sup>*****</sup>
1.	95	180			174
2.					175
3.					
4.			390		
5.					
6.	95			270	
7.				370	
8.				270	
9.					
10.	80	140	390		
11.					
12.					200
13.					200
14.		180			
15.	270	500	780	910	749

1. Overall Mean	3209/58	= 55 min.
2. Subject Area Mean:		
LAW	270/6	= 45
Grenades	500/9	= 56
SFC	780/12	= 65
FDC	910/15	= 61
MI6A1	749/16	= 47

Source: ARI/HRU, Fort Benning

<sup>a</sup> LAW Lessons:	<sup>**</sup> Grenade Lessons:	<sup>***</sup> Survey Firing Chart Lessons:	<sup>****</sup> 81mm FDC Lessons:	<sup>*****</sup> MI6A1 Lessons:
948-071-0005	942-071-0001	250-061-6301	010-071-6601	939-071-3009
948-071-0006	to	to	to	to
	942-071-0003	250-061-6306	010-071-6605	939-071-3012

TABLE L<sub>2</sub> CONVENTIONAL GROUP TRAINEE TIME FOR 10 CASE INSTANCES: IN MINUTES

CONVENTIONAL INSTRUCTION GROUP	LAW <sup>a</sup>	GRENADAES <sup>**</sup>	SURVEY FIRING CHART <sup>***</sup>	81mm FDC <sup>****</sup>	M16A1 <sup>*****</sup>
1.					
2.			300		330
3.				270	
4.				360	
5.	150				
6.	120	135			
7.		120			
8.					90
9.					135
10.					555
	270	255	300	630	
	1. Overall Mean		2010/38 = 53 min.		
	2. Subject Area Mean:				
	LAW		270/4 = 68		
	Grenades		255/6 = 42		
	SFC		300/6 = 50		
	FDC		630/10 = 63		
	M16A1		555/12 = 46		

Source: ARI/HRU, Fort Benning

<sup>a</sup> Comparable TEC LAW Lessons: 948-071-0005 948-071-0006	<sup>**</sup> Comparable TEC Grenade Lessons: 942-071-0001 to 942-071-0003	<sup>***</sup> Comparable TEC SFC Lessons: 250-061-6301 to 250-061-6306	<sup>****</sup> Comparable TEC 81mm FDC Lessons: 010-071-6601 to 010-071-6605	<sup>*****</sup> Comparable TEC M16A1 Lessons: 939-071-3009 to 939-071-3012
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TABLE L<sub>3</sub> COMPARATIVE TRAINEE TIME ESTIMATES: IN MINUTES  
LESSON CONTENT AREA

	LAW	GRENADES	SURVEY FIRING CHART	81mm FDC	M16A1	OVERALL
TEC LESSON EQUIVALENT	2	3	6	5	4	
NUMBER OF CLASSES OBSERVED:						
TEC	3	3	2	3	4	15
CONVENTIONAL GROUP	2	2	1	2	3	10
TOTAL TIME (IN MINUTES):						
TEC	270	500	780	910	749	3,209
CONVENTIONAL GROUP	270	255	300	630	555	2,010
MEAN TIME PER LESSON (IN MINUTES):						
TEC	45	56	65	61	47	55
CONVENTIONAL GROUP	68	42	50	63	46	53

Source: ARI/HRU, Fort Benning

APPENDIX M COMPOSITION OF A TYPICAL INFANTRY DIVISION AND SOME TEC II PROJECTIONS

TABLE M<sub>1</sub> ESTIMATED COMPOSITION OF A TYPICAL INFANTRY DIVISION

ORGANIZATIONAL UNIT	NUMBER OF SUCH UNITS IN DIVISION	TYPE	COMBAT ARMS (COMBAT SUPPORT COMBAT SERVICE)	NUMBER OF SOLDIERS IN UNIT	NUMBER OF SOLDIERS IN DIVISION
Infantry Battalion	9		CA	800	7,200
Field Artillery Battalion	4		CA	475	1,900
Armored Cavalry Battalion	1		CA	854	854
Air Defense Battalion	1		CA	558	558
Air Cavalry Battalion	1		CA	167	167
Aviation Battalion	1		CSUP	330	330
Signal Battalion	1		CSUP	666	666
Engineer Battalion	1		CSUP	798	798
Headquarters and Headquarters Company, Division (HHC)	1		CSUP	157	157
Headquarters and Headquarters Company, Brigade (BDE HHC)	3		CSUP	152	456
Division Artillery Battery	1		CSUP	227	227
Military Police Company	1		CSUP	191	191
Honest John Battalion	1		CSUP	268	268
Medical Battalion	1		CSERV	392	392
Supply and Transportation Battalion	1		CSERV	412	412
Maintenance Battalion	1		CSERV	829	829
Finance Company	1		CSERV	110	110
Adjutant General Company	1		CSERV	265	265
Division Support Command Company	1		CSERV	121	121
Total					15,901

Source: Estimates Provided By USACATB

TABLE M<sub>2</sub> ESTIMATED NUMBER OF SOLDIERS USING TEC II AND TEC III FOR  
A TYPICAL INFANTRY DIVISION, BY ORGANIZATIONAL UNIT

ORGANIZATIONAL UNIT	NUMBER SOLDIERS IN UNIT TYPE IN DIVISION	ESTIMATED NUMBER OF SOLDIERS USING:					
		TEC II COMMON LESSONS	TEC II INFANTRY MOS AND BRANCH LESSONS	TEC II ARMOR LESSONS	TEC II FIELD ARTIL- LERY LESSONS	TEC II AIR DE- FENSE LESSONS	TEC III LESSONS
Infantry Battalion	7,200	7,200	5,800	720	-	-	450
Field Artillery Battalion	1,900	1,900	-	-	1,700	190	200
Armored Cavalry Battalion	854	854	690	770	-	50	50
Air Defense Battalion	558	558	-	-	60	500	50
Air Cavalry Battalion	167	167	100	20	-	100	50
Aviation Battalion	330	330	50	-	-	50	50
Signal Battalion	666	666	100	100	-	-	50
Engineer Battalion	798	798	200	400	-	-	100
HHC	157	157	20	10	-	20	50
BDE HHC	456	456	200	100	-	-	25
Division Artillery Battery	227	227	-	30	150	-	25
Military Police Company	191	191	100	-	-	-	10
Honest John Battalion	268	268	-	40	100	50	30
Medical Battalion	392	-	-	-	-	-	50
Supply and Transportation Battalion	412	-	-	-	-	-	50
Maintenance Battalion	829	-	-	-	-	-	50
Finance Company	110	-	-	-	-	-	10
Adjutant General Company	265	-	-	-	-	-	20
Division Support Command Company	121	-	-	-	-	-	25
Total	15,901	13,772	7,260	2,190	2,010	960	1,345

Source: Estimates Provided By USACATB



## APPENDIX N

### DOCTRINAL CHANGE

1. The Directorate of Educational Technology, Educational Consulting Division, Infantry School, Fort Benning indicated that FM's and TM's and TEC lessons undergo review on an appropriate annual basis.

If there are minor TEC changes, the question arises whether to make the changes or to "teach around them," i.e., simply alert the learner to the changes. In the opinion of staff, soft areas of instruction (e.g., leadership, intelligence) are more likely to change than hard areas (e.g., rifles, antitank weapons). For example, the machine gun FM's and TM's are now being changed--to any significant degree--for the first time in 10 to 12 years.

Most current TEC lessons cover hard areas of instruction such as tanks, rifles. Staff also indicated that TEC lessons are easier to change than are the FM's and TM's since the major revision costs are related to preparing a new answer print and to reproducing and distributing new lesson cassettes.

2. The Armor School, Fort Knox found it difficult to estimate the effects of doctrinal change on TEC lessons.

Staff suggested, for example, that at this time last year they did not know that some 60% to 80% of gunnery doctrine would be modified as a result of lessons learned during the most recent Arab-Israeli conflict. A year ago, current doctrine was based upon a Vietnam-type situation.

It was staff judgment that normal, evolutionary doctrinal change occurs about every three years, because it takes that long to identify and synthesize new information. An additional year is required to disseminate the new doctrinal guidance to the operating unit level in the field. Thus, although the shortest period of time in which a TEC lesson change could occur is one year, the most likely estimate is about three years since the number of minor changes made in that period of time could confuse the learners. In another sense, however, lesson changes for special cases could be made more quickly, if desired, through the TEC system than through the FM/TM system as it now functions.

3. The TEC Division, Artillery School, Fort Sill indicated that artillery doctrine is in a state of rapid change and that even the lessons currently under development on 35mm slides are outdated before the answer prints can be produced.

In more stable areas (e.g., chemical, biological, and radiological warfare), staff see an average four to five year period between changes. Staff also emphasized the tactical lessons learned from the last Mideast conflict. They also indicated that it would be easier to change TEC lessons than to change the FM's and TM's.

4. The TEC Development Division, Directorate of Training Development, Air Defense School, Fort Bliss estimated that changes would be required in 1-1/2 to 2 years.

## APPENDIX O

### SOME GENERAL METHODOLOGICAL PROCEDURES

1. In identifying cost factors for the two training approaches, RBS tried to keep all cost estimates as comparable as possible.
2. Inflation factors incorporated into the cost estimates were based upon a table supplied by Mr. William Hambley, DACA-BUR. These factors are presented in Table O<sub>1</sub> of this appendix.
3. Hourly, daily and monthly time estimates were converted into dollars using salary tables for military and civilian personnel and incorporating fringe benefit factors. These tables (O<sub>2a</sub> and O<sub>2b</sub>) are also supplied in this appendix.

TABLE O<sub>1</sub>  
INFLATION FACTORS

<u>FY</u>	<u>R&amp;D %</u>	<u>O &amp; M % (OPERATIONS AND MAINTENANCE)</u>
65	1.53	
66	2.41	
67	2.76	
68	3.50	
69	4.49	
70	4.66	
71	3.50	
72	2.91	
73	3.50	
74	3.73	11.8
75	8.20	12.0



DOCUMENTATION FOR TABLES O<sub>2a</sub> and O<sub>2b</sub>  
Army Salary Schedules (Table O<sub>2a</sub>)

<u>Fiscal Year</u>	<u>Document Identification</u>	<u>Date of Issue</u>	<u>Effective Date</u>
1975	RCSDD-Comp. (A&AR)1193	(not indicated)	10/1/74
*1974	DOD Instruction #722.025-Ch2	6/5/73	7/1/73
1973	DOD Instruction #722.025 (Encl 1)	6/5/72	7/1/72
1972	DOD Instruction #722.025 (Encl 3)	(not indicated)	7/1/71

Civilian (GS) Salary Schedules (Table O<sub>2b</sub>)

<u>Fiscal Year</u>	<u>Document Identification</u>	<u>Date of Issue</u>	<u>Effective Date</u>
**1975	<div style="display: inline-block; vertical-align: middle; font-size: 4em; line-height: 1;">{</div> <div style="display: inline-block; vertical-align: middle;"> Xerox copies of card size  General Salary Schedules  (provided by Bob Verbeke.) </div>	10/74	10/74
*1974		(not indicated)	10/73
1973		"	1/73
1972		"	1/72

\*"Prior to 1 Oct. '74 CATB, identified as G-2-H-7-7."

\*\*Includes three separate corroborative documents (Personnel Dept., Naval Air Supply Depot):

- (1) "New Civilian (GS) Pay Scales" Chart published in the Compound Newspaper.
- (2) "General Salary Schedule" Chart included in a GEICO (private company) pamphlet.
- (3) Transmitted message from Secretary of Navy, specifying Executive Order 11811.

(Also listed on an unidentified sheet titled "General Schedule.")

TABLE O<sub>2a</sub>  
ARMY SALARY SCHEDULES

1972 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u>BENEFITS</u>	<u>HOUR RATE</u>
06	21,198	24,389	11.73
05	16,394	19,820	9.53
04	13,203	16,523	7.94
03	10,743	14,025	6.74
02	7,660	10,373	4.99
01	5,622	7,834	3.77
E9	11,085	13,326	6.41
E8	9,303	11,690	5.62
E7	7,686	9,901	4.76
E6	6,347	8,564	4.12
E5	4,454	6,415	3.08
E4	3,225	5,078	2.44
E3	2,264	3,991	1.92
WO-4	12,905	16,242	7.81
WO-3	10,288	13,354	6.42
WO-2	8,534	11,864	5.70
WO-1	6,435	9,268	4.46

TABLE O<sub>2a</sub> (continued)

## ARMY SALARY SCHEDULES

1973 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u>BENEFITS</u>	<u>HOUR RATE</u>
06	22,665	27,188	13.07
05	17,674	21,951	10.55
04	14,022	17,977	8.64
03	11,567	15,316	7.36
02	8,306	11,175	5.37
01	6,503	9,090	4.37
E9	12,001	14,799	7.11
E8	9,996	12,806	6.16
E7	8,317	10,896	5.24
E6	6,786	9,359	4.50
E5	5,002	7,205	3.46
E4	4,299	6,306	3.03
E3	4,044	5,911	2.84
WO-4	13,849	17,415	8.37
WO-3	11,120	14,424	6.93
WO-2	9,338	13,045	6.27
WO-1	6,826	10,022	4.82



TABLE O<sub>2a</sub> (continued)

## ARMY SALARY SCHEDULES

1974 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u><math>\bar{c}</math> BENEFITS</u>	<u>HOUR RATE</u>
06	23,833	28,670	13.78
05	18,790	23,238	11.17
04	15,358	19,379	9.32
03	12,540	16,120	7.75
02	8,794	11,626	5.59
01	6,825	9,521	4.58
E9	12,810	15,575	7.49
E8	10,524	13,338	6.14
E7	8,682	11,447	5.50
E6	7,173	9,754	4.69
E5	5,666	8,087	3.89
E4	4,638	6,631	3.19
E3	4,309	6,180	2.97
WO-4	14,758	18,406	8.85
WO-3	12,025	15,682	7.54
WO-2	9,793	13,367	6.43
WO-1	7,012	9,916	4.77

TABLE O<sub>2a</sub> (continued)

## ARMY SALARY SCHEDULES

1975 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u><math>\bar{c}</math> BENEFITS</u>	<u>HOOR RATE</u>
06	26,276	32,343	15.55
05	20,931	26,177	12.59
04	16,949	21,516	10.34
03	14,246	18,429	8.86
02	10,991	14,558	7.00
01	7,811	10,444	5.02
E9	14,004	18,216	8.76
E8	11,527	15,417	7.41
E7	9,635	13,123	6.31
E6	7,931	11,109	5.34
E5	6,328	9,401	4.52
E4	5,272	7,892	3.79
E3	4,789	6,937	3.34
WO-4	16,335	20,889	10.04
WO-3	13,363	17,579	8.45
WO-2	10,695	14,770	7.10
WO-1	8,987	12,328	5.93

Composite (Standard) Rates include Basic Pay + Basic Allowance for Quarters, Miscellaneous Expense, and Incentive and Special Pay.

Hourly Rates equal Composite Rates divided by 2080. Daily, weekly and monthly rates equal 8 hours, 40 hours and 1/12 of a year respectively.

TABLE O<sub>2b</sub>

CIVILIAN (GS) SALARY SCHEDULES

1972 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u>BENEFITS</u>	<u>HOUR RATE</u>
GS14	24,888	26,989	12.98
GS13	21,237	23,029	11.07
GS12	17,982	19,500	9.37
GS11	15,085	16,358	7.86
GS10	13,771	14,933	7.18
GS 9	12,518	13,575	6.53
GS 8	11,349	12,307	5.92
GS 7	10,261	11,127	5.35
GS 6	9,241	10,021	4.82
GS 5	8,295	8,995	4.32
GS 4	7,416	8,042	3.87
GS 3	6,604	7,161	3.44
GS 2	5,854	6,348	3.05



TABLE 0<sub>2b</sub> (continued)  
CIVILIAN (GS) SALARY SCHEDULES

1973 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u><math>\bar{c}</math> BENEFITS</u>	<u>HOOR RATE</u>
GS14	25,398	28,377	13.64
GS13	21,671	24,212	11.64
GS12	18,350	20,502	9.86
GS11	15,394	17,199	8.27
GS10	14,053	15,701	7.55
GS 9	12,775	14,273	6.86
GS 8	11,581	12,939	6.22
GS 7	10,471	11,699	5.62
GS 6	9,430	10,536	5.07
GS 5	8,465	9,458	4.55
GS 4	7,569	8,456	4.07
GS 3	6,740	7,530	3.62
GS 2	5,975	6,676	3.21

TABLE O<sub>2b</sub> (continued)  
CIVILIAN (GS) SALARY SCHEDULES

1974 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u><math>\bar{c}</math></u> <u>BENEFITS</u>	<u>HOURLY RATE</u>
GS14	27,479	29,798	14.33
GS13	23,433	25,411	12.22
GS12	19,829	21,503	10.34
GS11	16,627	18,030	8.67
GS10	15,163	16,443	7.91
GS 9	13,791	14,955	7.19
GS 8	12,501	13,556	6.52
GS 7	11,297	12,250	5.89
GS 6	10,173	11,032	5.30
GS 5	9,127	9,897	4.76
GS 4	8,158	8,847	4.25
GS 3	7,264	7,877	3.79
GS 2	6,438	6,981	3.36

TABLE O<sub>2b</sub> (continued)  
CIVILIAN (GS) SALARY SCHEDULES

1975 SALARY SCHEDULE

<u>GRADE</u>	<u>BASIC SALARY</u>	<u><math>\bar{c}</math> BENEFITS</u>	<u>HOOR RATE</u>
GS14	28,993	31,440	15.12
GS13	24,724	26,811	12.89
GS12	20,923	22,689	10.91
GS11	17,545	19,026	9.15
GS10	16,001	17,351	8.34
GS 9	14,553	15,781	7.59
GS 8	13,192	14,305	6.88
GS 7	11,924	12,449	5.99
GS 6	10,737	11,643	5.60
GS 5	9,632	10,445	5.02
GS 4	8,608	9,335	4.49
GS 3	7,664	8,331	4.00
GS 2	6,796	7,370	3.54

Pay with (Fringe) Benefits includes Basic Pay at Step 5 levels + 8.44% increment for retirement, insurance, and vacation allowances.

Hourly Rates equal Pay with Benefits divided by 2080. Daily, weekly and monthly rates equal 8 hours, 40 hours and 1/12 of a year respectively.